12 DECEM 1952

ONE SHILLING

FLIGHT

and

AIRCRAFT ENGINEER

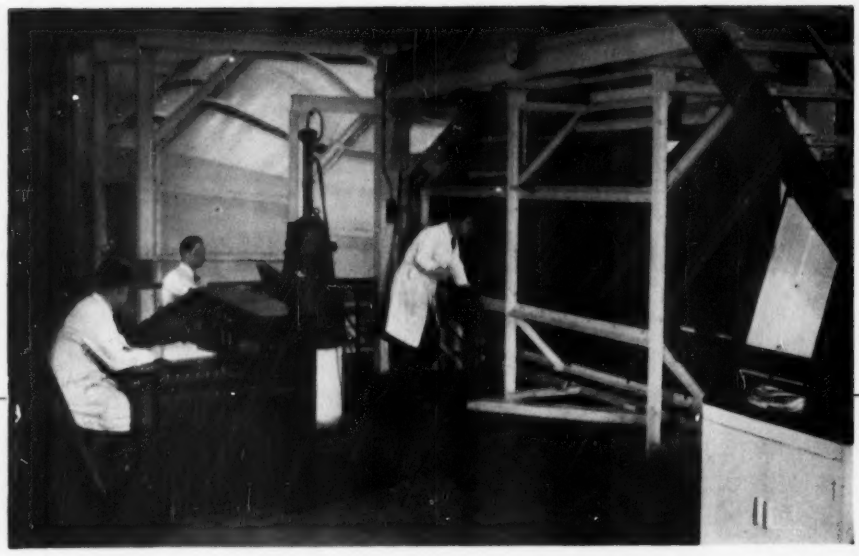
OFFICIAL ORGAN OF THE ROYAL AERO CLUB

'Bristol' Britannia

Tyres, Wheels, Brakes, by

DUNLOP

Wind-tunnel drives



'ENGLISH ELECTRIC' design and manufacture wind-tunnel drives, as well as complete test plants for reciprocating and turbine-type engines, superchargers, compressors and other engine auxiliaries. The illustration shows the working section of a subsonic wind-tunnel powered by 'ENGLISH ELECTRIC' equipment.

'ENGLISH ELECTRIC'

aerodynamic testing equipment

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Plant Sales, Stafford

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

P5.3

Shorts announce

vacancies in their technical departments for suitably qualified personnel as

JIG AND TOOL DRAUGHTSMEN AND PLANNING ENGINEERS

Unique opportunities exist for men to widen their experience with a Company which is not only doing extensive research and development work but is also putting into production three of the country's leading aircraft.

Jig and tool draughtsmen with experience of aircraft structures, machine shop fixtures, machine tool design, press tool design, prepared to show initiative working with a team developing the latest production techniques, are acceptable.

Planning engineers with technical and/or practical experience of structures, electrics, hydraulics, plastics, machining, capable of transmitting information to the shops.

Men with a reasonable knowledge of production techniques (preferably in the aircraft industry) and anxious to join teams specialising in the production of prototypes will find wide scope in any of these departments.

DESIGN OFFICES

PRODUCTION OFFICES

Those who wish to settle down in this part of the country are assured of positions which are permanent and pensionable, together with excellent opportunities for promotion in all spheres within the Company's organisation. Spacious factory and office buildings situated on the waterfront and within a mile of the city centre, coupled with an excellent canteen and adequate transport facilities, make ideal working conditions. All these amenities will be found on inspection.

Arrangements will be made to interview applicants at centres within easy reach of their own homes. If the interviews prove satisfactory applicants will, at the Company's expense, be afforded the opportunity to visit the factory and to survey the living conditions.

Details of modern housing accommodation available and facilities for removal will be supplied at interviews.

Initial applications should be made to

CHIEF PRODUCTION ENGINEER

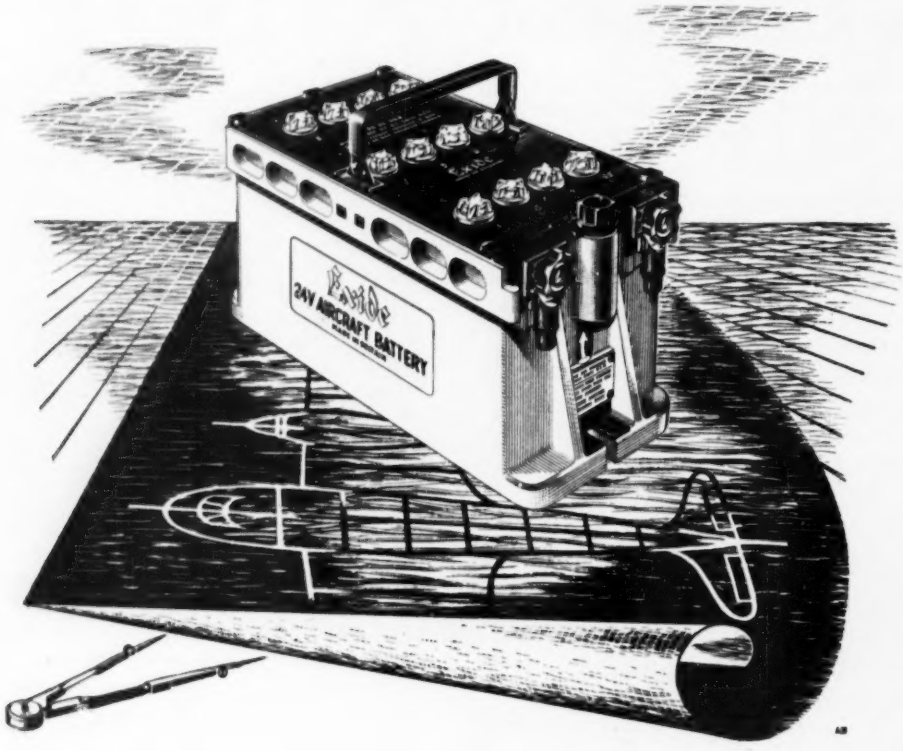
MODERN HOUSING ACCOMMODATION

Short Brothers & Harland Limited

AIRPORT ROAD, QUEENS ISLAND, BELFAST

A

Current formula for Designers



Figures of minimum battery weight for the given aircraft are modified now—by the advent of the new Exide 24V., lightest British aircraft battery for its voltage and capacity. Weight is money, in civil aircraft. Other things being equal, the lightest battery is the best. For the Exide 24V. it can be claimed that other things are better than equal. In both design and performance, this new battery steps ahead. Lightest—and best in its own right.

Exide **AIRCRAFT BATTERY**

24 V. 15 Ah. 32½ lb. — 24 V. 25 Ah. 43½ lb.

A PRODUCT OF CHLORIDE BATTERIES LIMITED · EXIDE WORKS · CLIFTON JUNCTION · NEAR MANCHESTER

Sitting Room Comfort across the World

Cabin Atmosphere Control (popularly known as "Pressurization") enables modern aircraft to operate at all altitudes whilst giving the passengers perfectly normal sitting-room breathing and temperature comforts. This company is proud to have been pioneers in providing the equipment which makes this comfort available on Civil and Military aircraft the world over.

NORMALAIR

DISCHARGE VALVES · PRESSURE RELAY VALVES
INWARDS RELIEF VALVES · DUCT RELIEF VALVES
CLIMB INTERRUPTER SWITCHES · NON-RETURN VALVES
SAFETY VALVES · PRESSURE CONTROLLERS
PERSONAL BREATHING EQUIPMENT

NORMALAIR LTD · YEOVIL · ENGLAND

There's a place for YOU in the R·A·F

Ever flown in a Meteor? It's quite an experience. One of the best-behaved aircraft the R.A.F. has ever had, Meteor pilots say. This NF.11—the night-fighter version—carries a navigator too.

Perhaps you find it hard to visualize yourself flying with the R.A.F. You're not alone there. Thousands of young men felt the same way—until they tried. There's nothing miraculous about it. Provided you've had a reasonably good education and can pass a flying aptitude test (which you can now take at 16) there's no reason why there shouldn't be a place for **you** in the R.A.F. As pilot or navigator you will be commissioned if suitable. Within 8 years of joining you can be a Flight Lieutenant earning more than £1,000 a year (including marriage allowance). It's a good life with interests and excitement you'll never know as a civilian. Anyway it's worth sending the coupon for fuller details. Post it today while you remember.

TO: ROYAL AIR FORCE (F.R.104) VICTORY HOUSE, LONDON, W.C.2

Please send details of life in the R.A.F. (*Tick which you require*)
(*Applicants from British Isles only*)

(A) In the Air		(B) On the Ground	

NAME .....

ADDRESS .....

..... Date of Birth .....

* *If you are 14-17—and keen—join the Air Training Corps* *

THE BLACKBURN *Universal*

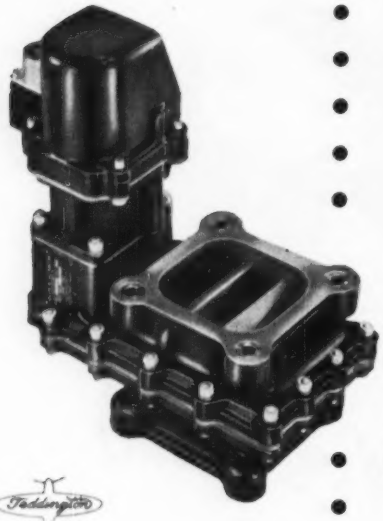
is designed and destined
for the world-wide carriage of
Military or Civil Freight
and Passengers

The military version has been ordered by

THE ROYAL AIR FORCE

Teddington

HOT AIR VALVE WITH 3 in GATE



This is a general-purpose isolation valve for use in hot-air systems. It will work at temperatures up to 350° C. and against pressures up to 150 p.s.i. Under these conditions it provides a shut-off valve with a leak rate of less than 1 cu ft/min. It is available in forms to suit all installations and the high temperature integral actuator can be supplied to cover a range of speeds without change of physical dimensions.

Teddington

Teddington AUTOMATIC CONTROLS

TEDDINGTON CONTROLS, LTD., CEFN COED, MERTHYR TYDFIL, SOUTH WALES. (Merthyr Tydfil 666)

EQUIPMENT FOR ALL TYPES OF AERONAUTICAL PHOTOGRAPHY AND VISUAL RECORDING

Vinten

W. VINTEN LIMITED, NORTH CIRCULAR ROAD, LONDON, N.W.2. *Telephone : GLAdstone 6373*

NEWTON
TRADE PRODUCT MARK
Hydratruck
THE TRUCK WITH A HUNDRED USES
British Manufacture

Simply Hydraulics—PLUS
A FEW STROKES OF THE HANDLE...

AN ALL-ROUNDER THAT SLASHES HANDLING COSTS

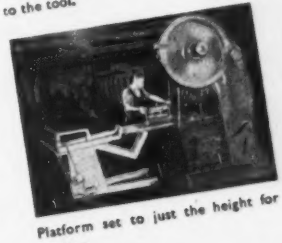
HALVE YOUR HANDLING COSTS

A tricky job for one man but safe and easy with a Hydratruck.

AND DO THE JOB BETTER, CHEAPER, QUICKER AND SAFER

The Hydratruck is unique and fully guaranteed. Loads of half a ton are lifted by hand to nearly five feet in under a minute — compare this with manhandling.

Four cwt. tool easily handled by one man. No trapped fingers or damage to the tool.



Platform set to just the height for loading.

WRITE TODAY FOR FULL DETAILS

EVERY TRADE HAS A USE FOR A HYDRATRUCK

A quicker turn round and no damage to the goods.

AGENCY AND DISTRIBUTOR TERMS ON APPLICATION

A MEMBER OF THE NEWTON GROUP

Tel.: Shepherds Bush 3443 (4 lines)
Grams.: Newsorber, Ealux, London

POWER JACKS LIMITED
VALETTA RD · ACTON · LONDON · W3

That isn't all plane sailing!

Is that an aircraft, or a hawk with hiccups? Ask the intrepid birdman in the cockpit! Even HIS confidence is shaken by the trail of nuts and bolts that follow in his wake. No doubt, at this very moment, he is putting a hasty patch on his parachute and praying for a one-piece landing.

What a pity he spurned the practice of wiser aeronauts and refused to fit "Jac" Spring Washers beneath nut. They never let a man down . . . however far! For all who swoop about in the cerulean blue, "Jac's" the boy to beat the jitters! For all who put aeroplanes together, "Jac" is the washer that keeps them that way.

Jac

REVERSE SIDE

Made in sizes to fit every standard bolt, their saw-tooth serrations give a positive lock that is unaffected by vibration and shock. Send for samples and details.

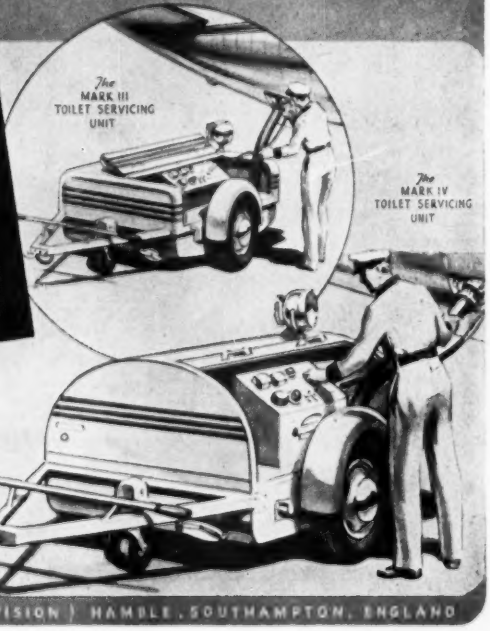
SPRING WASHERS

DAVID POWIS & SONS LTD. SPARKBROOK · B'HAM TELEPHONE · VICTORIA · 1264

AST

AIRCRAFT DIVISION

Designers & Manufacturers of aircraft components and equipment, and specialists in experimental gas turbine installations

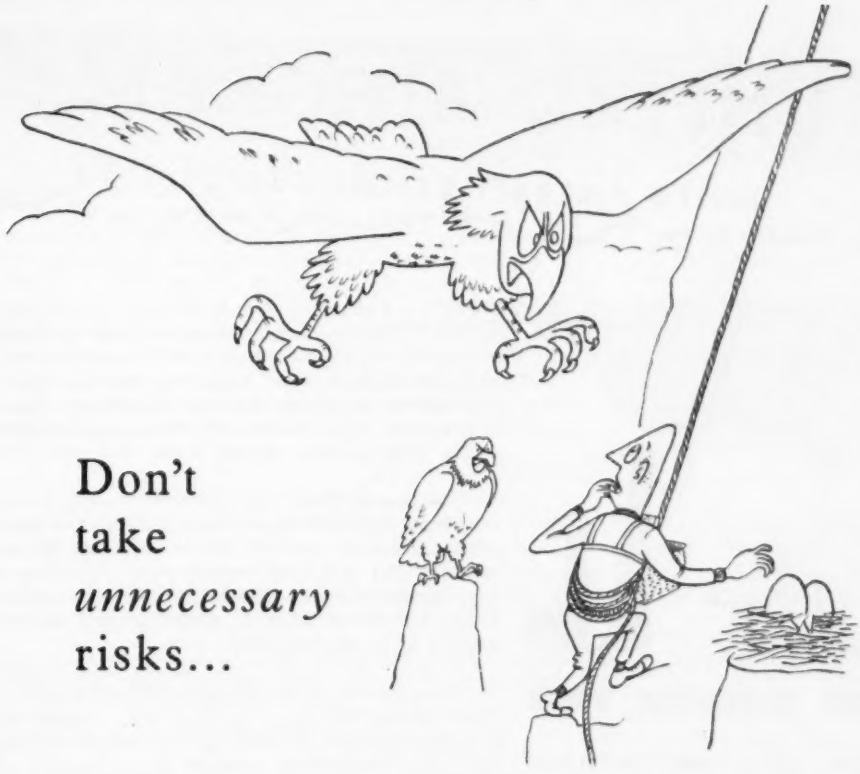


AIRCRAFT TOILET SERVICING UNITS

These units are completely self-contained and can be electrically or manually operated by one man.
Additional drain fittings are provided for connections to the waste water system from pantry, etc., and illumination for night servicing is also incorporated.
The Mark III Unit has capacity for servicing 4 full aircraft toilets, and the Mark IV will service 20-25 toilets.

A Member of the Hunter Siddeley Group

AIR SERVICE TRAINING LTD. (AIRCRAFT DIVISION) HAMBLE . SOUTHAMPTON, ENGLAND



Don't take *unnecessary* risks...

No doubt about it — many a proposition that looks like a good egg turns out to be a mare's nest; just when we think we've laid hands on something good, the feathers start flying and we finish up with a load on our mind. It's happening every day too — whether you're a carefree climber or a mercenary magnate, it could happen to you — *or* you — or even *you*. Every time you buy small components with a big element of doubt, you're hunting for trouble with a capital T — you will, however, get out of it with a good spring at the right time. And speaking of good springs . . .

WARNING TO MANUFACTURERS: You take unnecessary risks whenever you buy 'cheap' springs of uncertain quality. low initial outlay will never balance the ultimate harm they may do to your product, your prestige and your purse. When you specify "Springs by Salter" you're certain of getting top-flight quality—quality that cuts out risk and guarantees years of highly-efficient, dependable service. Only the best — of materials and workmanship — is good enough for SALTER.

INSIST ON QUALITY

Buy **SALTER** *of course*

Est. 1760

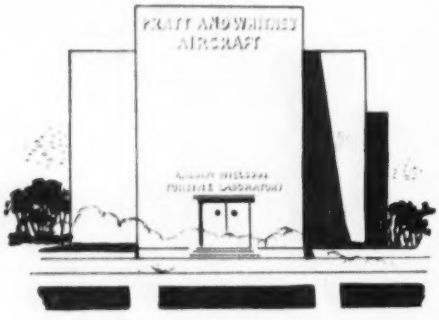
GEO. SALTER & CO. LTD., WEST BROMWICH

M.W.339

UNITED AIRGRAM

UNITED AIRCRAFT EXPORT CORPORATION

PRATT & WHITNEY TO ENLARGE JET DEVELOPMENT -- A program for enlarging jet engine development and test facilities at Pratt & Whitney Aircraft's main plant at East Hartford was announced recently. The company-financed program will cost several million dollars, and calls for an addition to the Andrew Willgoos Turbine Laboratory and conversion of a number of experimental test cells from piston to jet work.



These additional jet engine facilities are required by Pratt & Whitney Aircraft's rapidly expanding role in jet engine development and production, and will enable this Division to accelerate its jet development program and help reduce the time it takes to get a new engine into production.

Three new high altitude test cells will be added to the Willgoos Laboratory. These cells will be capable of testing full scale advanced type jet engines under conditions simulating supersonic speeds and altitudes up to 55,000 feet. The Willgoos Laboratory now has a single cell of this type. The additional test units will maintain the laboratory's position as the most complete privately owned jet development facility in the world.

PRATT & WHITNEY AIRCRAFT TO MAKE RAMJET ENGINES -- Late in August it was announced that the Pratt & Whitney Aircraft Division will extend its range in the jet field by developing and building ramjet engines for high-speed guided missiles. The project is being undertaken for the United States Navy.

At the same time it was revealed that Pratt & Whitney Aircraft will have the advantage of six years of research on ramjets which has already been conducted at East Hartford by the Research Department of United Aircraft Corporation. The ramjet engine research program was commenced under U.S. Navy auspices in 1946, and a new laboratory, built exclusively for study of ramjet burners, has been operated by United Aircraft's Research Department since April 6, 1950.

PRATT & WHITNEY AND HAMILTON STANDARD PRODUCTS ON NEW JET AIRPLANE -- Two divisions of United Aircraft Corporation -- Pratt & Whitney Aircraft, and Hamilton Standard -- played an important part in American Airpower's latest answer to air invasion.

The U.S. Air Force announced recently its newest automatic jet warplane, the Lockheed F-94C Starfire, an all-weather interceptor. The Starfire is the first production aircraft to fly with the new Pratt & Whitney J-48-P-5 jet engine, which

produces a 6,250-pound thrust without afterburner. When using an afterburner, a device which reignites the jet exhaust, thrust rises appreciably, making the Starfire the most powerful single-engine airplane in production in the U.S. today.

SIKORSKY HELICOPTER MAKES 5,000TH ARS PICKUP IN KOREA -- The 5,000th rescue of a fighting man in the Korean war by the U.S. Air Force 3rd Air Rescue Squadron was accomplished on June 21, when a sergeant, who had been badly wounded during a battle for a vital Korean hill, was evacuated from a front-line first-aid station to a behind-the-lines surgical hospital by a Sikorsky H-5 (S-51) helicopter.

The sergeant was hit by an enemy shell at 3:15 a.m. on the morning of June 21, and an hour later was at a first-aid station near the front. At 7:45 a.m., the helicopter which flew him from the front landed, and 25 minutes later, the patient was at the Army mobile surgical hospital in the rear area.

The 5,000 pickups by the 3rd ARS since the start of the Korean conflict have included many rescues of pilots and crewmen shot down behind enemy lines, as well as the evacuation of wounded soldiers. The rescues, a number of which were accomplished in the face of enemy ground-fire, have been both on land and in coastal waters. In addition to Sikorsky H-5s and Sikorsky H-19s, Grumman SA-16 amphibians have been used.

SIKORSKY H-19 HELICOPTERS MAKE FIRST TRANS-ATLANTIC HOP -- Two U.S. Air Force Air Rescue Service Sikorsky H-19 helicopters landed at Prestwick, Scotland, on July 31 to complete the first trans-Atlantic helicopter flight in aviation history. The two big Sikorskys made the cross-ocean flight as part of a journey that took them from Westover Air Force Base, Massachusetts, to Weisbaden, Germany. The mission was undertaken by the U.S. Air Force to investigate the problems of long-range ferrying of helicopters.

Total distance covered by the two helicopters in their flight from Westover to Prestwick was 3,535 miles. Air time was 42 hours and 25 minutes. No mechanical difficulties were encountered, but adverse weather conditions at several stops enroute stretched the elapsed time for the Atlantic crossing to 15 days, eight hours.

Project commander was Major Richard B. McVay, and the four crew members of the helicopters were Capt. V.H. McGovern, Capt. H.C. Jeffers, Lieut. H.W. Moore, and Capt. G.O. Hambrick. The Air Rescue Service, under the command of Col. J.C. Bailey had over-all responsibility.

Highly important accomplishments of the trans-ocean trip included a demonstration of the fact that in the future it may be more convenient and faster to ferry big helicopters to their destinations than to disassemble them and ship them by another carrier. The test also raised the potential value of helicopters by showing how large helicopters of the future could be stationed at a few strategic spots in various parts of the world and could, on short notice, fly to virtually any place on the globe within a few hours.

UNITED AIRCRAFT EXPORT CORPORATION
EAST HARTFORD 8, CONNECTICUT, U.S.A.
European office: 3/5 Warwick House Street, London, SWI, England.

GANNET

Search *with single-engine economy*

Strike *with twin-engine performance*

Security *with twin-engine safety*

Simplicity *with single-engine installation*

Designed and constructed for the Royal Navy by

FAIREY

THE FAIREY AVIATION COMPANY LIMITED, HAYES, MIDDLESEX

FLIGHT
and
AIRCRAFT ENGINEER

First Aeronautical Weekly in the World

Founded 1909

No. 2290 Vol. LXII. FRIDAY, 12 DECEMBER 1952

EDITOR
MAURICE A. SMITH, D.F.C.

ASSISTANT EDITOR
H. F. KING, M.B.E.

ART EDITOR
JOHN YOXALL

Editorial, Advertising and Publishing Offices:
DORSET HOUSE,
STAMFORD STREET,
LONDON, S.E.1.

Telegrams, Flightpress, Sedist, London.
Telephone, Waterloo 3333 (60 lines).

Branch Offices:
COVENTRY
8-10, Corporation Street.
Telegrams, Autocar, Coventry.
Telephone, Coventry 5210.

BIRMINGHAM, 2
King Edward House,
New Street.
Telegrams, Autopress, Birmingham.
Telephone, Midland 7191 (7 lines).

MANCHESTER, 3
260, Deansgate.
Telegrams, Iliffe, Manchester.
Telephone, Blackfriars 4412 (3 lines).
Deansgate 3595 (2 lines).

GLASGOW, C.2.
26b, Renfield Street.
Telegrams, Iliffe, Glasgow.
Telephone, Central 1265 (2 lines.)

SUBSCRIPTION RATES
Home and Overseas: Twelve months £3 3s. 0d. U.S.A. and Canada, $10.00
BY AIR: To Canada and U.S.A., six months, $16.

IN THIS ISSUE:

The Canberras Home Again 718
Gas-Turbine Lubrication 721
The F.E.2 Series - - - 724
The Padre Takes Over - 729
New Angles - - - - 730
Aid to Approach - - - 732
Idonesian Air Force - - 732
M. Churchill on Defence Production - - - - 735
Jet Transports: U.S. Ideals 736

Elastic Programme

NO amount of thought and planning can eliminate entirely the element of chance. Where the many imponderables of international affairs are concerned, nobody dares hope that every carefully weighed forward decision will prove to have been exactly right. The changes now to be made in defence production, reflecting changes in the defence budget, appear to be a sensible adjustment to meet current requirements under altered conditions. Details of the Prime Minister's statement appear on page 735, and of a later announcement in amplification on page 720.

People most concerned with the changes as they affect the aircraft industry have indicated little surprise. Largely, they had been foreseen and the need for them accepted, though the chopping and changing of contracts and plans is never welcome. Some orders had, in fact, long been considered disproportionate, while late and long-drawn-out deliveries would have reduced the value of others. Super-priority Canberras are among the aircraft types concerned, but a large number remain on order and current deliveries will be unaffected.

While the continuance of anxiety over the nation's pocket is depressing, the pegging of annual defence expenditure is not altogether so, for expansion is to continue and the same amount is to be spent, but over a longer period. America, too, is planning a slight "stretch-out." In the first place, this suggests that the risk of war is receding, or at least is no greater than it was twelve months ago. Secondly, by reduction of effort on second-line types, the latest military aircraft (which represent a tremendous improvement over their predecessors and, what is more, will give a distinct edge over all known possible adversaries) should come into service sooner than had been expected; thirdly, the increasing export demand for civil aircraft will be less influenced by military commitments.

It has been suggested that increased production of current types for Nato countries will to some extent make up for the curtailment of orders for the R.A.F. Further subcontracting of components for those aircraft which the Ministry of Supply are "desperately anxious" to get into production will also help to tide over some companies. Fortunately, with adjustments there will continue to be plenty of work for nearly all companies. During the coming year the total labour force is expected to increase by 10,000.

The Air Council is not to be envied its task of forecasting requirements and periods of greatest danger. However, there is little doubt that a number of bad miscalculations were made some five or six years ago. In particular, a serious run-down of the aircraft industry was permitted; our researches into high-speed and supersonic flight were altogether too limited; the placing of orders was long delayed; and we set our sights for fighter performance too low. One unhappy result is that the R.A.F. squadrons have no fighter in service to match the best of other nations. But this wretched state of affairs is slowly passing, and the R.A.F. itself was never in better shape.

Progressing in Strides

Advancement in aircraft design has not been smooth and progressive in every case. At one time it was said that it would take British designers many years to make up for the loss of experience of civil airliners occasioned by the war. But this prediction has been proved wrong, and several have indeed managed to bridge that gap so well that today they have already established a lead over all comers. A similar stride has been taken with the development of the new four-jet medium bombers, while aerodynamic advances and improvement in performance in the new prototype fighters are most marked. The problems now calling for attention are those of cost and time of production. The first must not ruin the country, and the second must not ruin the operational usefulness of the aircraft.

It seems probable that in the years to come, and in the light of the greater knowledge of aircraft design and construction, much greater stress will have to be placed on selecting a few of the best designs as early as possible, ordering them without delay and producing relatively small numbers with all speed. A realistic rate for even small-scale production may demand more than one production line, even though it be uneconomical from the point of view of tooling and the other associated costs.

THE CANBERRAS HOME AGAIN

South American Goodwill Tour Ends—in an English Fog—

IT has become customary for the Royal Air Force to send a goodwill mission to attend the installation ceremony of each Chilean president. Such an occasion took place at the beginning of last month and this time Bomber Command agreed to send four Canberras from No. 12 Squadron, based at Binbrook, Lincolnshire, supported by servicing crews and spares carried in two Hastings transports. The original plan was a quick three-week visit stopping at as few places to and from Santiago as possible; but the word got around and the visit grew until the Canberras were committed to appearing at fifteen Pan American centres—and there were still some "disappointed customers" even then.

A.V-M D. A. Boyle, C.B., C.B.E., A.F.C., A.O.C. No. 1 group, led the flight and also piloted one of the Canberras throughout. S/L. L. G. Press, A.F.C., commands No. 12 Sqn; other aircrew and ground personnel who went on the tour are shown in the accompanying illustrations, with the exception of S/L. H. L. Jones, the flying personnel medical officer at Binbrook.

As already recorded in these pages, the Hastings left Binbrook on Sunday, October 19th and the Canberras took off the next day, bound for Gibraltar. The route from there was then: Dakar (French West Africa), Recife (Brazil), Rio de Janeiro (Brazil), Montevideo (Uruguay), Buenos Aires (Argentine), Santiago (Chile), Lima (Peru), Bogota (Colombia), Caracas (Venezuela), Belize (British Honduras), Mexico City (Mexico), Havana (Cuba), Kingston (Jamaica), Ciudad Trujillo (Dominica), Port of Spain (Trinidad), Belem (Brazil), and back *via* Recife, Dakar and Gibraltar.

The aircraft were due back at Binbrook last Friday, December 5th; but the English weather stepped in and caused the first diversion of the tour. Binbrook was closed by fog and the Canberras were redirected to St. Eval; and so we made our way, in a Valetta of Transport Command, to the milder climate of Cornwall —and found the Canberras had beaten us to it.

Inside the operations block we found A.V-M Boyle and his men, all looking distinctly tanned. Air Chief Marshal Sir Hugh Pughe Lloyd, A.O.C. in C. Bomber Command, had flown down to greet them. Standing on a chair he said "We are very proud indeed of you; you have all done a most wonderful job. We have followed your progress with interest and envy; you have shown what the Canberra can do. I am only sorry that our weather has let you down on your last leg; we had everything arranged at Binbrook . . ." Sir Hugh then read a speech of welcome from the Secretary of State for Air (who, but for the fog, would have been present) and another from the Foreign Secretary. Then it was the turn of the crews of 12 Sqn to tell their story.

Without exception, all remarked upon the warmth and friendliness with which they had been received everywhere. It was, said A.V-M. Boyle, a most inspiring business to see how many there were in distant lands who were still proud of England and all that we could do. It had not been a sales tour; but many people had become, or had previously been, interested in the Canberra, and the tour had no doubt done much to satisfy their curiosity.

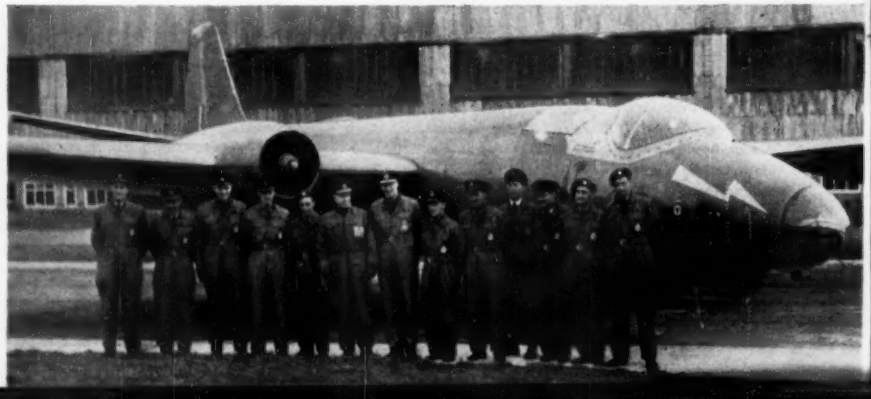
From the Air Vice-Marshal and other members of the flight we learned that the main purpose of the tour had been to attend the ceremony in Santiago, in which city they remained from November 1st to 5th. Here, three aircraft flew over the Presidential parade, and the local club offered a light aircraft so that the crews could make themselves more familiar with the city's topography. Three aircraft put on a show in Rio and two in Trinidad; elsewhere, one aircraft did a turn on its own. The Canberra's slow-flying qualities particularly appealed to the audiences, who knew the aircraft to be fast but were quite unprepared for such docile handling. A total of 44 demonstration and passenger flights was made. The original idea had been to take "the highest in the land" up for a joy-ride; but that worthy was usually reduced to a grease-spot before getting airborne, which played havoc with his dignity. Later, "sprog P/Os" were taken instead, to their huge delight.

Beside WD 987 are her crew: F/O. B. Brownlow, A.V-M. D. A. Boyle, and Sgt. J. G. Simms.

Actually, many crews said that cockpit refrigeration was a "must" (we believe later production Canberras are so equipped). In its absence, cockpit drills were learnt with unprecedented thoroughness and checks reduced to a fine art, so that the aircraft could be entered at the last possible moment before take-off time. But heat did not particularly worry the Canberras, which operated quite efficiently from Bogota (8,500ft) and Mexico City (7,350ft) and provided much useful information on the use of such airfields.

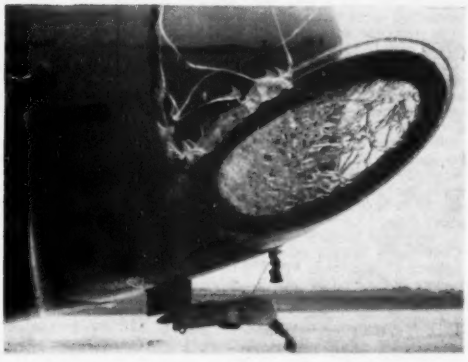
More useful knowledge concerned high-altitude meteorology, about which the locals knew very little. Upper-air winds of 150 knots had been encountered—but, unfortunately, never from astern. The fastest leg was Havana-Kingston, flown at 553 m.p.h. The South Atlantic crossings of 1,715 n.m. were covered at 460 m.p.h. westbound and 517 m.p.h. coming home. In any case, most of the route had not previously been flown by a jet aircraft, so record-breaking could not have been avoided.

During the demonstration in Rio, one of the Canberras collided with a vulture, with dire results to both parties. Bad weather in England stopped B.O.A.C. from flying out a new Canberra nose for some days. When it arrived, the repaired aircraft made one



When we asked the aircrew to line up they reminded us that South American food might have caused expansion; but we got them all in. Left to right: F/O. B. Brownlow, S/L. L. G. Press, A.F.C. (O.C. 12 Sqn.), F/O. Shelton, F/L. J. W. Harper, D.F.C., Sgt. A. B. Fraser, Air Chief Marshal Sir Hugh Pughe Lloyd, K.B.E., C.B., M.C., D.F.C., who greeted them, A.V-M. D. A. Boyle, C.B., C.B.E., A.F.C., F/O. M. G. Jones, F/L. G. Stephenson, D.F.C., F/L. J. G. W. Stroud, F/L. B. Roydor, Sgt. E. R. Buttle and Sgt. J. G. Simms.

The servicing team, most of whom are pictured here, was: F/L. S. W. Pattinson (12 Sqn. engineer officer), F/Sgt. G. H. Overton, F/Sgt. P. L. Hallums, F/Sgt. L. Mallinson, Sgt. W. Dempster, Sgt. J. J. R. Davis, Sgt. E. W. Basham (a noted sailplane pilot), Cpl. J. C. Dale. Cbl. G. B. Gilbert, S/Tech. R. F. Andrews and S.AC. G. K. Mason. With them are Air Chief Marshal Sir Hugh Pughe Lloyd, S/L. Press and A.V-M. D. A. Boyle.



Those who know the thickness of the Canberra's bomb-aiming panel will appreciate the violence of the impact which caused this damage. It occurred during a low-level demonstration in Brazil when an unlucky vulture got in the way.

of the best flights of the tour, catching up the other three in two hops. One hop was Rio-Santiago (flown, despite a severe headwind, in 4 hr 36 min) which involved the Andes crossing at considerable altitude followed by a violent let-down to the destination. From Rio onwards the press persisted in mentioning a "crashed aircraft," and felt sure that a replacement must have sneaked out from Britain. The newspapers had otherwise been very kind.

Aircraft were navigated individually, although having taken off together all usually arrived at about the same time. R/T. was used as much as possible, although even this was unavailable on the run to Belize. Automatic radio compass was the only aid, although one aircraft carried W/T. and used QTEs across the Atlantic. Met. was very limited, except at main centres. The usual procedure was to rely upon airline pilots for actuals, which were then co-ordinated, after a fashion. Forecasting was almost non-existent. This was particularly true of the West coast, and the Canberras were grateful to a Panagra pilot who reported an unexpectedly strong headwind of 130 knots upon leaving Bogota.

Servicing was carried out by F/L. Pattinson and his team lifted in the Hastings. Facilities were quite good at chief centres. Most of the positioning of kerosine was done by Shell, who also arranged much of the tour's ground transport and entertainment. "They were great," said one recipient. Similar praise was voiced for B.O.A.C. whose station managers went far beyond "the line of duty" in their service. And while awarding bouquets, it should be mentioned that the Canberras worked perfectly throughout the 24,000 miles. This observation involves English Electric, Rolls-Royce, Dowty, Dunlop, B.T-H., and a host of other famous names, all of whose products maintained their reputation. Tyres were expected to be a problem, and stocks were positioned at Rio and Caracas; in the event only two bursts were suffered. Oxygen was another requirement to be uplifted; American oxygen is, as is well known, too wet for use in British systems—it freezes up at expansion valves.

Airfields were, in the main, very good. Almost the only exception was Belize—British territory, be it noted—where the fourth Canberra sank two feet into the ground while doing pre-take-off checks. It was dug out and got away 55 minutes late. The Canberras were given priority "on the air" for control purposes, and were freed from any local procedure—always providing there was any control available.

Two incidental cases of sickness were reported. Both were local fevers and Belize was again the unhappy spot. A third malady afflicted a member of the servicing team, who was left behind in Lima, along with one of the Hastings which was also somewhat seedy. The only other casualty was a monkey, which, given to one crew, escaped, never to be seen again.

Coming home again, it was very noticeable how the colder air of Europe improved performance. Crossing the Spanish coast on the morning of December 5th, the diversion call came through; so the Canberras turned to port and headed for St. Eval, which was reached at about 1100 hr.—nearly an hour before they were due in at Binbrook. This was the only off-schedule landing of the tour—a fact which speaks volumes for the crews and their aircraft.

For the information of the spotters, we may add that the Canberras were standard tip-tanked B.2s (WD 987, 990, 993 and 996) the oldest aircraft—A.V-M. Boyle's—having previously flown to Nairobi in record time (*Flight*, October 17th). All the aircraft had done over 100 hours and were by no means new. But Canberras seem to "age" less than any other aircraft. The only point that ever seems to show wear is the grille over the starter-cartridge exhaust; otherwise the South American quartet belied their 24,000 miles and 10 foreign countries in six weeks.

Some of Jamaicas' more rugged mountains make an impressive backdrop to three of the Canberras at Palisadoes airport, Kingston.

FROM ALL QUARTERS

The Coronation and the R.A.F.

THE EARL MARSHAL'S office announced early this week the amended programme of events in which the Queen and the Duke of Edinburgh will take part at Coronation time. It covers the last week of May, the whole of June, and the first three weeks of July. The three most important occasions for the Royal Air Force will be the fly-past on June 2nd following the Coronation ceremony and before the Queen's Commonwealth broadcast; a second fly-past, in connection with the Trooping the Colour on the Queen's Birthday on July 11th; and the R.A.F. Review on July 15th.

The composition and route of the Coronation Fly-past is already being planned. It is likely to be on a larger scale than any Battle of Britain Fly-past and may well be the largest ever seen over London. It is expected to be representative of most Commands of the two Allied Tactical Air Forces and probably of Commonwealth Air Forces as well. It is assumed that the Queen will watch the aircraft from the balcony at Buckingham Palace on return from her Coronation.

On June 15th Her Majesty is to review the Fleet, and it can be assumed that Naval Aviation will be fully represented.

The Duke and G.A.P.A.N.

IT is announced that H.R.H. The Duke of Edinburgh has accepted the invitation of the Guild of Air Pilots and Air Navigators of the British Empire to become their Grand Master. The Queen, who relinquished that appointment on her accession to the Throne, has become the Guild's Patron. The date of the installation ceremony has not yet been fixed, but it is possible that it will be arranged near the time of the Duke's first solo.

Defence Production: Mr. Sandys' Statement

SOME comments on the detailed effects of the changes in the defence-production programme announced by the Prime Minister have been made by Mr. Duncan Sandys, the Minister of Supply. The changes, he explains, were dictated by the necessity of preventing expenditure climbing beyond the limits of the country's financial capacity. Although the curve of aircraft production will now rise less steeply than had been previously planned, the output of military aircraft will continue to expand, and the labour force engaged on defence work in the aircraft industry is actually expected to rise by some 10,000 during the next twelve months. In addition, there will be a further increase on the civil side as a result of the growing demand for British airliners. On the other hand, unfortunately, the changes are expected to create temporary redundancies in two or three firms, involving some 2,500 of a total labour force of 200,000.

The six aircraft types affected are Meteors, Venoms, Vampires, Balliols, Pembrokes, Varsities and Canberras. Of these, Canberras will continue to be accorded super-priority and will still be produced by Avros and Shorts, as well as the parent company, but not in the numbers originally envisaged. Vampire Trainers are not included with other Vampire types, and, in fact, the orders for these aircraft will probably be increased. Meteor N.F.11s are virtually unaffected by the cut-back in other Meteor orders.

A decision regarding Naval aircraft has still to be made, but it is understood that the cuts will not be extensive, the Navy having decided to bear its share of defence economies elsewhere.

The fact that orders for some types have been reduced makes it even more urgent to speed production of the super-priority types, says Mr. Sandys. The Hunter, Swift, Javelin and Gannet will now account for a larger proportion of the total programme.

Although sub-contracting will, where possible, be extended to avoid redundancy in factories where extra capacity has been built up, temporary difficulties are likely to be experienced at some factories. The most serious position will be at Glosters, but it will be corrected when Javelin production gets into its stride.

The Avro Vulcan is not yet on the super-priority list, but plans for its production are going ahead well. It is probable that some sort of super-priority scheme for the production of civil aircraft will be announced soon.

New Zealand Race News

FURTHER information has been given by the Royal Aero Club concerning the England-Christchurch Air Race, regulations for which were reviewed in *Flight* of January 11th and February 1st this year.

The start has now been fixed for Thursday, October 8th, 1953. As in the case of most air races, a large number of last-minute entries is probable; potential competitors are reminded, however, that the last date for submission of entries is January 31st, 1953. The starting-point is still the subject of consultation and negotiation: the number and type of entrant aircraft will doubtless influence its choice.

Competing aircraft in both sections will be started at short intervals, the starting order not being based on handicap speed; and adjustments for starting times and handicaps will be made at the end of the race. It is expected that the leading aircraft will arrive at the intermediate control-point (one of several alternative airfields near Basra) shortly before dawn on October 9th, and at Christchurch early the following day.

The handicap formula (quoted in *Flight*, February 1st), which has already provoked much discussion among possible entrants, is intended to encourage the design of an efficient transport aircraft suitable for operation over long-distance routes. The basis of the formula is to give credit for low overall cost per ton-mile of payload carried. The cost is approximately proportional to the all-up weight, so that the ratio of this weight to the product of payload and block-speed gives an approximate measure of cost per ton-mile of payload. It is believed that the formula adopted will go a long way towards achieving the object of rewarding commercial efficiency over such long-haul routes.

In response to enquiries, fuller information on those items which may be classed as "passenger furnishings" has been given. They include passenger and stewards' seats; bunks, soundproofing, floor covering, doors and partitions, coat and luggage compartments, shelves and magazine racks, berth ladders and stairways, curtains, bars, food and drink, glasses and crockery, lighting, decorations, upholstery, lockers, murals, etc., wash-stands, basins, toilets, mirrors, cabinets, tables and chairs, stoves, cooking appliances, refrigerators, cupboards, trays, water tanks and heaters, cabin air-conditioning equipment and emergency equipment for passenger use. The weight of all such equipment should be included in the "passenger furnishings" section on the entry form.

Completed forms should be sent to either the Secretary of the Canterbury International Air Race Council at 116, Hereford Street, Christchurch (P.O. Box 339), New Zealand, or the Secretary-General of the Royal Aero Club at 119, Piccadilly, London, W.1, England.

Diversions

IF the fog which enveloped London and the Home Counties towards the end of last week closed down airfields, it signally failed to deter some hundreds of enthusiasts from attending several important aviation annual dinners. These included the McKenna Trophy gathering of the Empire Test Pilots' School, Farnborough; the London University Air Squadron dinner; and the annual dinners and dances of, respectively, the Herts and Essex Aero Club and the Northern Heights Model Flying Club. Successful blind approaches to all these functions were made by members of *Flight* staff, and their reports will appear next week, when the space situation will be rather easier.

Helicopter Ground Testing

TWO papers were presented, under the joint title *Simulation of Helicopter Flight Loads by Grounds Tests*, at the meeting of the Helicopter Association of Great Britain at the Royal Aeronautical Society on Friday last. Chairman for the evening was B.E.A.'s Dr. G. S. Hislop, Ph.D., B.Sc., A.R.T.C., M.I.Mech.E., A.F.R.Ae.S. The first paper was given by Mr. M. J. Brennan, B.Sc., A.M.I.Mech.E., A.F.R.Ae.S. (chief designer, Saunders-Roe Ltd.) and was based mainly on his company's work on the Skeeter. The resemblance of the helicopter to an aircraft engine unit, in many respects, had inevitably influenced the testing method described at length by the speaker. Details were given of the strain-gauge recorder system used to measure the loads, and of the actual positioning of the strain-gauges.

A series of flight tests was followed by ground-tests in which the engine conditions in flight were reproduced. Trends indicated by the fluctuating load results were described, and it was found that the ground-tests covered the flight cases for oscillating stresses, the predominant factor in fatigue running.

Mr. Raoul Hafner (chief designer, Helicopter Department, Bristol Aeroplane Co., Ltd.), who read the second paper, had widened its subject to include the simulation of flight operating conditions in general. An illuminating historical reference introduced the subject, and led to an account of the purpose of ground-testing and the general considerations involved. Typical examples of partial simulation were listed, and illustrated by photographs. Three of the more important of these ground-tests—endurance tests on main rotor controls, power plant and transmission, and the main rotor—were described in detail.

We hope to print a more detailed account of the two main papers, and of the discussion which followed, in next week's issue.

GAS-TURBINE LUBRICATION

A New Synthetic Oil Developed in this Country

SOME revealing information on the exacting lubrication requirements of modern gas turbines is brought to light by the Esso Petroleum Company in announcing their new synthetic lubricant, Turbo Oil 35.

From the early days of the aircraft industry those concerned with engine development have recognized the inexorable relationship between fuel and oil quality and specific engine power output. Engine development, as the Esso company points out, must proceed hand in hand with that of the fuel and oil : at all times the petroleum industry must be fully aware of the engine builders' forward thinking. Fuel and lubricant manufacturing processes take time to develop, and new plant cannot be designed and installed overnight. The existence today of the new synthetic gas turbine lubricant is the result of co-operation of this nature.

A satisfactory aircraft gas-turbine lubricant must be capable of providing proper lubrication for :—

(1) The bearings of the compressor and turbine shaft.
(2) The various reduction-gear trains which provide power take-off and drive the accessories. The power take-off is large in the case of the turboprop and comparatively small in the turbojet.
(3) The various accessories, driven either directly from the engine or from a separate gearbox.
(4) Also, the lubricant must be a suitable actuating medium for the various servo mechanisms which are operated hydraulically. Of these, the airscrew-pitch operating mechanism of the turboprop is the most important.

Satisfactory lubrication must be maintained over the full temperature range through which the various parts of the engine operate. The lowest temperature at which the lubricant must be able to work is preferably −60 deg C (−76 deg F). For some operations −50 deg C (−58 deg F) will suffice. Good low-temperature behaviour is particularly important, because the lubrication system of the gas turbine (unlike that of the piston engine) does not lend itself to fuel dilution for viscosity reduction.

Bearing Lubrication

As a first example, bearing-lubrication requirements may be considered. The rotor-shaft bearings in all current engines are of ball or roller types. Thrust loads are high on axial compressor engines, and a certain minimum viscosity of the lubricant is necessary if the bearings are not to fail prematurely owing to track fatigue. Excellent lubricating properties are needed to avoid seizure and scoring between the cage and its locating surfaces.

The bearings must be properly lubricated from the minimum starting temperatures already quoted up to the maximum temperature which they reach in service. This must be considered under two conditions :—

(1) Maximum running temperature under full power sea-level conditions.
(2) Maximum static temperature which the turbine-disc bearing reaches if the engine is stopped. This is higher than the running temperature, due to soak-back of heat from the turbine blades through the disc to the bearings—which, because the engine is stationary, cannot be cooled. Maximum running temperatures seldom exceed 250 deg C, but under the static soak-back condition 300 deg C may be exceeded. Oil must remain in the bearings to ensure adequate lubrication at the next cold start.

Little use is made in the turbojet of the high-pressure oil for the operation of servo mechanisms, but in the turboprop it must frequently be relied on for airscrew pitch-change operation. The most critical condition is emergency feathering at take-off, and the speed with which this can be carried out may determine the safety of the aircraft. Ten seconds is the maximum safe time, and the lubricant must be of sufficiently low viscosity at take-off temperature—which may be little higher than the minimum at which the aircraft is operated (−50 deg C)—to enable the feathering pump to feather the blades in this time.

In the matter of starting from cold, experience with a number of turbojets and turboprops suggests that the level of starting performance is set by the general behaviour of the lubrication system. The limiting temperature is that at which oil pressure can be built up in the system.

The foregoing requirements are conflicting in that, on the one hand, they call for low volatility with high viscosity at high temperature, together with good load-carrying capacity, while, on the other, low viscosity at low temperatures is needed for quick feathering and good cold starting. Gear-lubricating properties, states the Esso Company, cannot be increased by the addition of active chemical agents, because any which are sufficiently active to be of value at gear-operating temperatures become over-active and cause dangerous corrosion in the hotter parts of the engine. Low viscosity-changes with temperature cannot be achieved by the addition of what are usually called viscosity-index improvers, because experience shows that these deposit out as gummy residues in the hot parts of the engine, fouling the system and causing bearing failure.

At a very early stage, in 1945, the Esso organization in this country decided that this new requirement was something which could not be met by any known petroleum lubricant or combination of such lubricant with chemical additives. The problem was therefore tackled from first principles and a lubricant built up by synthesis which has the desired properties of low viscosity-change with temperature, high flash-point and low volatility, coupled with excellent lubricating properties and stability.

It became apparent at an early stage that progress would be very slow if development were confined to work in the laboratory with mechanical test-rigs. The fact that a satisfactory lubricant is available at this time, say Esso, is very largely due to the confidence and support of the major engine builders and of the Ministry of Supply, who always made engines available for tests. Were such a lubricant not available today the engine builders would be faced with the problem of increasing the weight of their engines by installing heating systems or special dilution systems using volatile material other than fuel, and the operators would have a more complex aircraft-operation problem on their hands.

Oil consumption of both turbojet and turboprop engines is inherently low, and due only to leakage or to evaporation in the hot parts of the engine.

The present position with Esso Aviation Turbo Oil 35, state its makers, is that it has been run satisfactorily in all current turbojets and turboprops, and of these the latest marks of Rolls-Royce and Armstrong Siddeley axial turbojets cannot be operated under design conditions on any other lubricant.

The new lubricant is admittedly expensive, but the price can be expected to become lower as the demand increases. It is too early to speak with certainty, but there is every indication that used oil can be satisfactorily and quite cheaply reclaimed provided due care is taken in handling to ensure that it does not become contaminated with mineral oil or other fluids.

As with so many novel and important developments started in this country, the use of synthetic turbine lubricants has spread from the initial work carried out by Esso Development Company's laboratories at Abingdon to the United States, and considerable quantities of the components used in its manufacture are now exported. Naturally, other companies are not unaware of these developments but it is understood that no other synthetic lubricating oil has reached such an advanced state of development. The Ministry of Supply has indicated that full Service trials with Esso Turbo Oil 35 are to begin in January.

WIND-TUNNEL AERODYNAMICS

THE speaker at the Royal Aeronautical Society on Tuesday, December 2nd, was J. C. Gibbings, Ph.D., B.Sc.(Eng.), a graduate member of the Society who is engaged on wind-tunnel design at the National Aeronautical Establishment, Bedford. Arranged by the Graduates' and Students' Section, the lecture was titled *Aerodynamics of Wind-Tunnel Design*.

After giving a brief historical outline of wind-tunnel development, Dr. Gibbings described the various basic types of tunnel. The variation in air-density ratio between model and full-scale original, with change of Mach number and of model scale, was shown. The passage of the air around the tunnel was studied, and the relevant aerodynamic problems at each section examined. The effect of the screen-drag coefficient on the turbulence level was then shown by means of theoretical and experimental curves, and the problem of ensuring even velocity-distribution was discussed.

An account of the main aspects of contraction-section design, including the avoidance of adverse velocity gradients, was followed by an examination of the most suitable working-section and diffuser shapes. The lecturer mentioned particular problems in diffuser design in the case of supersonic flow, and went on to describe the types of drag associated with the wind tunnel fan, and acceptable tip-speeds. Structural limitations on fan design were briefly mentioned, but major structural and economic factors in general wind-tunnel design were outside the scope of the paper.

Questions following the lecture were varied, and the subject-matter included transonic tunnels, contraction and diffuser shapes, turbulence reduction with increased number of screens, and the factors involved in fan design.

HANDSOME STRANGER: Photographed at Filton a few days ago was this Breda-Zappata 308 airliner, powered with four Bristol Centaurus 568 engines driving five-bladed Rotol airscrews. With this British propulsive system the aircraft has completed some 250 hours of trouble-free flying in Italy.

HERE AND THERE

Wright Brothers Lecture

ON December 17th—49th anniversary of the Wright Brothers' first flight—the Sixteenth Wright Brothers Lecture of the Institute of the Aeronautical Sciences will be delivered in Washington. The lecturer will be Mr. William Littlewood (vice-president, engineering, of American Airlines, Inc.), who will speak on *Technical Trends in Air Transportation.*

Dry Work

A NEW development in aerial crop-spraying, now engaging the attention of agricultural research-workers, is the application of dessicants to dry wheat or barley preparatory to harvesting. The chemicals have the effect of checking the rise of water from the roots.

Scorpion Wing Fault

THE U.S.A.F. has disclosed the discovery of "wing weakness" in the Northrop F-89 Scorpion, all aircraft of which type were grounded in September following a series of fatal crashes. Remedial modifications have been agreed upon, and are being incorporated on the Northrop production line and in existing Service aircraft.

Staking a Claim

SPEAKING at a recent meeting at Sheffield, Mr. Eric Mensforth said that municipal authorities should take immediate action to secure helicopter landing-sites, for only those cities which had the foresight to prepare would be able to enjoy the benefits of the air link, whenever it materialized. Admitting that it would require "six years of hard work and a lot of money," before 30-40 seater twin-engined helicopters—"the only types that it would be economical to run on inter-city service of this sort"—could be ready, Mr. Mensforth stressed that local authorities would, nevertheless, have to make the space available for them now. Mr. Mensforth, who is president of the Helicopter Association, is vice-chairman of Westland Aircraft, Ltd.

On the Climb

BY agreement with the U.S. Air Line Pilots' Association, Pan-American Airways have granted a 10.75 per cent pay increase to their pilots. Captains, now making 951 to 1,263 dollars (about £340 to £450) a month, will be paid on a new scale ranging from 1,020 to 1,358 dollars (£364 to £484). Second pilots will earn from 704 to 890 dollars (£251 to £317).

A.R.S. Activities

ANSWERING questions at the Aircraft Recognition Society's "brains trust" (December 17th) will be Mr. Peter Masefield, S.L. Neville Duke, Maj. James C. Hamilton, U.S.A.F., and Mr. James Hay Stevens. For the Society's All-England Recognition Contest (January 17th) several entries of teams have been received from the Army, and others are expected from the Royal Navy; the U.S.A.F., also, has announced its intention of entering teams. The hon. secretary is Mr. Gerald J. Pollinger, 39-40 Bedford Street, London, W.C.2.

Dornier Revival?

DIRECTORS of the Dornier works have announced in Munich that they are ready to resume the production of passenger and freight aircraft as soon as the Allied ban against German production is lifted.

Distinction

A LETTER in the correspondence columns of *The Times* suggests that the word "ingineer" (as used, with various slight modifications, in most Continental countries) be adopted to describe the professional chartered engineer. The word is derived, the writer points out, from *ingenio*, of the same root as "ingenious."

But Whose?

DEVELOPMENT of "a true intercontinental guided missile" is, in the opinion of Mr. J. H. Kindelberger, chairman of the board of North American Aviation, "just over the horizon." Such a weapon, he said in a recent lecture, will be capable of delivering at any point on the earth's surface, and within a few hours, "a warhead carrying infinite destruction."

Miss Cochran Joins Canadair

FROM Canadair, Ltd., comes news that they have engaged Miss Jacqueline Cochran, the well-known American airwoman as part-time flight consultant. Miss Cochran has flown 10,000 hours as a pilot and claims to hold more international air speed records than any living person. In the war she was an Atlantic ferry pilot.

Gyroplane Lifeboat

A DRAGONFLY helicopter from R.N. Air Station Gosport rescued four of the crew of a Danish gunboat which went aground on a sandbank off Great Yarmouth on December 3rd. Making two trips between ship and shore in failing light, the helicopter picked up two men on each, landing them at a recreation ground in Yarmouth. Nine others were rescued by lifeboats. The helicopter pilot was F/L. D. Kearns, with Lt. R. Hart as navigator.

That other B.E.A.

AT a meeting of Derby Town Council on December 3rd, members decided to protest to the British Electricity Authority against a proposal to erect a new power station within one mile of the perimeter of Derby Airport. The borough surveyor's report revealed that the works would have chimneys 425 feet high. It was also decided to approach the Derbyshire County Council, the Ministry of Civil Aviation, the Air Ministry and the Minister of Housing and Local Government in an attempt to have the proposals modified.

ROTOR DOWNWASH, flattening the grass and raising dust, adds drama to this picture of men of the U.S. 82nd Airborne Division taking part in an assault-landing exercise at Fort Bragg, North Carolina, with the aid of H-19 (Sikorsky S-55) helicopters. No. 848, the first British Naval squadron to be equipped with S-55s, formed recently at Gosport: it will serve in Malaya.

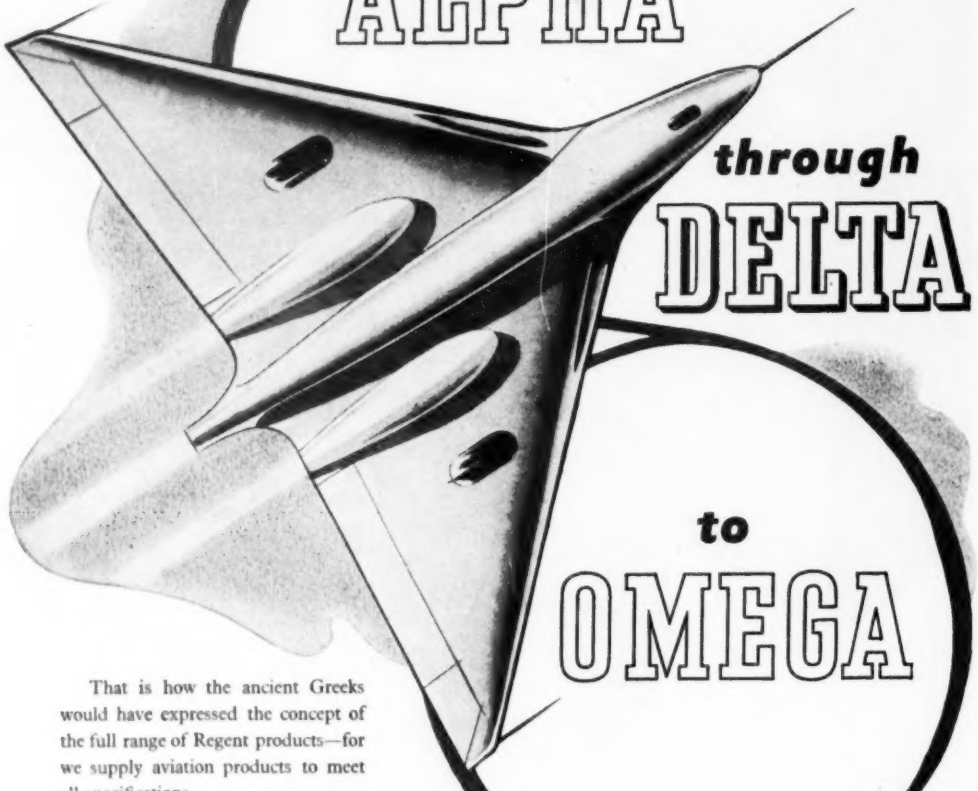
LTD

THIS MARK
ON ALL VANDERVELL
PRODUCTS

VANDERVELL
PRODUCTS LIMITED

VANDERVELL PRODUCTS LTD • WESTERN AVENUE • PARK ROYAL • LONDON

from
ALPHA
through
DELTA
to
OMEGA



That is how the ancient Greeks would have expressed the concept of the full range of Regent products—for we supply aviation products to meet all specifications.

Whether you are concerned with a piston engine, a gas turbine or airframe we have the specific fuels, oils and greases you need.

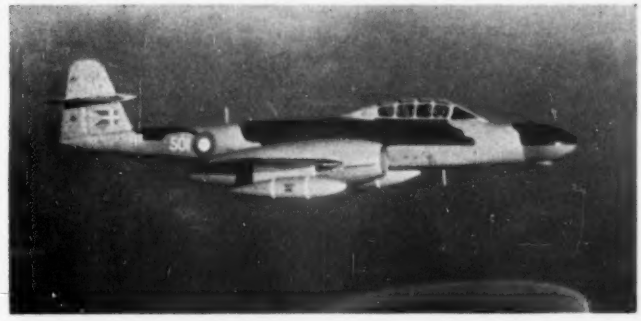
REGENT OIL COMPANY LTD.

CALTEX
REGENT

117 PARK STREET, LONDON, W.1

Telephone: Mayfair 8474 (15 lines)

AIRCRAFT INTELLIGENCE



STANDARD AND EXPERIMENTAL: As reported in "Flight" last week, the first four of a substantial number of Armstrong Whitworth Meteor N.F.11s (two Rolls-Royce Derwents) were delivered to Denmark on November 28th. One of these machines, in its national markings, is seen above. The piston-engined aircraft is the Macchi B.323 a note on which appears on this page.

Great Britain

Avro Vulcan B.1. For use on this delta-wing bomber the Irving company has made a large ribbon-type braking parachute. This type of 'chute has a double advantage over the "solid" pattern: the sudden shock load is taken more efficiently and it will fold into a smaller and lighter pack. Whereas many British designers were inclined to "laugh off" the braking parachute when the Americans began to exploit this German-developed idea, they are now fully appreciative of its properties in reducing landing runs and brake wear.

Vickers Viscount 701. The second production machine for B.E.A., G-ALWF, *Sir John Franklin*, made its first take-off from Brooklands on December 3rd and was then ferried to Wisley. Well over 100 hr flying has now been logged by its predecessor, G-ALWE, the flagship of the *Discovery* fleet, which is due to have completed acceptance trials by December 18th. The following registrations and names have been allocated to 18 future Viscounts for B.E.A. (six of the 26 on order have not yet been named or given registrations): G-AMNY—*Sir Ernest Shackleton*; G-AMNZ—*Robert Falcon Scott*; G-AMOA—*George Vancouver*; G-AMOB—*William Baffin*; G-AMOC—*Richard Chancelor*; G-AMOD—*John Davis*; G-AMOE—*Sir Edward Parry*; G-AMOF—*Sir Martin Frobisher*; G-AMOG—*Sir Humphrey Gilbert*; G-AMOH—*Henry Hudson*; G-AMOI—*Sir Hugh Willoughby*; G-AMOJ—*Sir James Ross*; G-AMOK—*James Cook*; G-AMOL—*David Livingstone*; G-AMOM—*James Bruce*; G-AMON—*Thomas Cavendish*; G-AMOO—*John Oxenham*; G-AMOP—*Mungo Park*.

Registration News. The Hercules-powered Blackburn Universal Freighter is now undergoing C. of A. trials and has been given the civil registration G-AMUX. Six new "long-nose" Bristol 170 Mk. 32 Freighters on order for Silver City Airways will be registered G-AMWA - F inclusive; the first machine is almost complete and is expected to fly shortly.

De Havilland's well-known demonstration model D.H.C.2 Beaver was recently bought by the London and Rhodesian Mining and Land Co., Ltd., and ferried out to its new base at Salisbury. Formerly registered G-ALOW, it now has the Southern Rhodesian markings VP-YJA. Its place at Hatfield has been taken by a new Beaver from Canada, painted all red and registered G-AMVU.

U.S.A.

Convair XF2Y. This high-speed marine fighter, to which reference was made in an article on hydro-skis in last week's issue, is expected to fly "in the near future." According to Mr. John Floberg, U.S. Assistant Secretary of the Navy, there is a promise—nothing more than a promise—of hydro-skis becoming applicable to commercial landplanes. "Very inexpensive operating bases" would then be usable and these would afford "almost infinite runways for highly loaded aircraft."

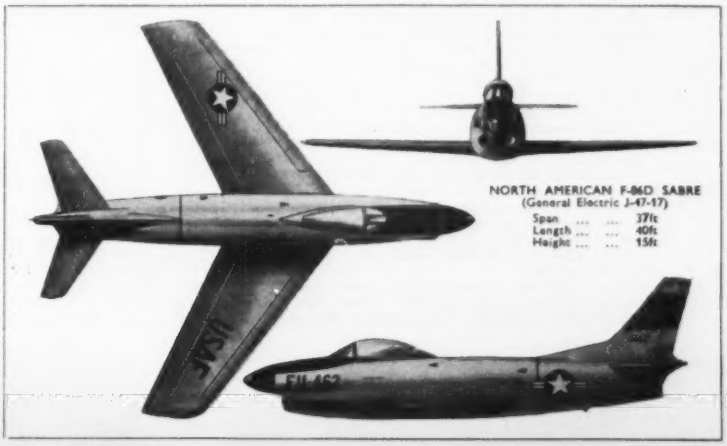
Lockheed P2V-6. This latest version of the Neptune, the first flight of which was made on October 14th, has been developed primarily for mine-laying and anti-submarine warfare. The new model differs from the P2V-5, which continues in quantity production, in its electronic equipment and "convertibility features." Night torpedo attacks, low-level and high-level bombing, and photographic reconnaissance are within the powers of the P2V-5. The engines are Turbo-Compound Wrights, and to assist take-off provision is made for eight 1,000-lb thrust JATO bottles. A longer nose, smaller tip-tanks and smaller radome are distinguishing features, and the internal tanks have been adapted for pressure fuelling. The new stainless-steel engine nacelles are "highly fire resistant."

France

Nord 3100. Developed from the Packet-like Nord 2501 transport, the 3100 is intended to have an all-up weight of 79,000 lb and a useful load of 28,600 lb; power will be provided by two Bristol Proteus turboprops.

Italy

Macchi B. 323. This is the latest of the Italian advanced trainers, and though the prototype is powered with a Pratt and Whitney R.1340 Wasp, an Alvis Leonides or Wright Cyclone can be fitted as an alternative. Moreover, although the first machine has a tail-down undercarriage, a nosewheel gear has been studied. A wing-mounted 7.7 mm gun and rockets or bombs can be fitted for armament training. Empty and gross weights are 3,725 lb and 4,960 lb respectively, and the maximum speed is quoted as 232 m.p.h. The take-off run is 220 yd and the climb to 3,280ft occupies slightly over 2 minutes.



An F.E.2B night bomber of No. 100 Squadron, Royal Flying Corps, operating on the Western Front.

THE F.E.2 SERIES

Historic Military Aircraft: No. 3

By J. M. BRUCE, M.A.

THIS special series of articles on famous British military aircraft of earlier years has been received with almost unprecedented acclaim, both by older readers who remember—and some of whom flew—the aircraft described, and by the newer generation to whom these famous types are little more than names. On October 17th we published J. M. Bruce's article on the D.H.4 and, on November 7th, his review of the Bristol Fighter series. Now he deals with that famous pusher, the F.E.

AT about nine o'clock on the evening of June 18th, 1916, 2nd-Lt. G. R. McCubbin of No. 25 Squadron, R.F.C., with Cpl. J. H. Waller as his observer, was flying an F.E.2B some 8,000ft above Annay on the last patrol of the day. On sighting three Fokker monoplanes over Lens, McCubbin went to the attack but was unable to prevent the defeat of a companion F.E.2B, manned by Lt. J. R. B. Savage and Air Mechanic T. Robinson. McCubbin pursued Savage's conqueror, although himself closely followed by the other two Fokkers, and Waller opened fire on the enemy machine just as its pilot realized his danger and began to take evasive action. The Fokker fell out of control, breaking up as it fell. The dead German pilot was Oberleutnant Max Immelmann, a redoubtable foe who, although he fell two weeks before the fury of the Somme was unleashed, had defeated no fewer than 16 Allied aircraft in combat.

Just over six years before this historic event, Mr. (now Sir) Geoffrey de Havilland began to teach himself to fly on an aeroplane which was the patriarch of the line that included the F.E.2B. The aircraft he used, and the 40 h.p. flat-four engine which powered it, were both designed and built by him, and the machine was his second design: his first broke up in the air during its first flight in early April, 1910. The second de Havilland aeroplane was completed about the end of May, 1910, and was successfully flown near Litchfield, Hants. At the end of the year Geoffrey de Havilland took up an appointment as test pilot and designer at His Majesty's Balloon Factory (as the Farnborough establishment was then called), and his aeroplane was bought by the War Office for test purposes. It thereupon became the first to be given a "Factory" designation.

It was named the F.E.1, or Farman Experimental, because in general design it resembled contemporary Farman biplanes. In the hands of various pilots the F.E.1 did a good deal of flying until it was finally written off by Lieutenant T. J. Ridge, who later lost his life in the crash of the S.E.1. Reconstruction was the order of the day at Farnborough, which was not then officially permitted to design and construct its own aeroplanes, and from the wreckage of the F.E.1 there arose the F.E.2: it first appeared (from what was by then the Army Aircraft Factory) in September, 1911.

The F.E.2 was unique among Factory machines in that it existed in two entirely dissimilar forms. The first F.E.2 was rebuilt from the crashed F.E.1, and the rebuilding was a radical one, for it produced a two-seat aeroplane of nacelle and tail-booms layout, powered by a 50 h.p. Gnôme rotary engine. Its performance was rather better than that of the F.E.1, but, most significant of all, it carried a Maxim machine gun on a pillar-type mounting in the front cockpit. Early in 1913 the F.E.2 was completely redesigned and rebuilt. The machine in its revised form was of more pleasing appearance than the original F.E.2, having a deep, commodious nacelle, and mainplanes identical to those of the B.E.2A. The 70 h.p. Renault vee-eight engine replaced the Gnôme. What the rebuilt F.E.2 did not have, however, was enough fin area to balance the side area of the nacelle, and this led to the destruction of the machine, on February 23rd, 1914. Mr. Roland Kemp, the pilot, was unable to regain control in a steep spiral descent and the F.E.2 crashed near Wittering. The passenger, Mr. E. T. Haynes, was killed.

The next F.E. was the F.E.2A, which had the 100 h.p. Green six-cylinder-in-line engine. This was another complete re-design, and was the immediate precursor of the war-time "Fees." The F.E.2A was a three-bay pusher biplane of remarkably sturdy construction, distinguished by an oleo undercarriage which incorporated a small nosewheel. The Green engine was not an unqualified success, however, and only 12 F.E.2As were built.

The machine was modified to take the 120 h.p. Beardmore engine and was renamed F.E.2B: its other designation of "Fighter Mark I" is now little known and seldom used. Like the early B.E.2Cs, the first F.E.2Bs had wings of R.A.F.6 section, but later machines had wings of R.A.F.14 section mounted at a larger angle of incidence.

The first F.E.2Bs in France were those which formed part of the equipment of No. 6 Squadron: on September 25th, 1915, that unit had on its strength four F.E.2Bs, eight B.E.2Cs and a single Bristol Scout. The first R.F.C. squadron to go to France equipped throughout with F.E.s was No. 20, which arrived on January 23rd, 1916. No. 25 Sqn followed on February 20th, No. 23 on March 16th, and No. 22 on April 1st. By the time of the Battle of the Somme, No. 18 Sqn had replaced its Vickers Gun-Buses with F.E.2Bs, and No. 11 Sqn had acquired eight of the type.

Although the F.E.2B did not have a remarkable performance, when it first appeared in France it proved to be a most effective fighting aircraft. The Fokker monoplane was proving to be an extremely painful thorn in the Allied side, and under the fire of its synchronized machine gun B.E.s, Moranes and Farmans were falling with disconcerting frequency. A measure of the Fokker's influence on contemporary aerial warfare can be assessed from the

The original F.E.1—a wholly de Havilland product.

F.E.2 with Maxim gun.

size of the escort provided on February 7th, 1916, for a single B.E.2C of No. 12 Sqn which was required to make a reconnaissance of certain railway lines in Belgium : three other B.E.2Cs, four F.E.2Bs, four R.E.7s and a Bristol Scout—12 aircraft in all—accompanied the reconnaissance machine. The arrival of the F.E.2B marked the beginning of the Fokker's decline, and its final defeat was hastened when the F.E.s were reinforced by the D.H.2.

The F.E.'s success was mainly due to the excellent field of fire, in all forward directions, provided by the pusher layout. The armament carried varied considerably, but the usual minimum consisted of a movable Lewis gun mounted on a bracket on the front of the observer's cockpit. This was often supplemented

The second F.E.2, with 70 h.p. Renault.

F.E.2A with 100 h.p. Green engine.

by a further Lewis on a tall pillar-mounting between the cockpits. This latter gun could be fired backwards over the upper wing, a feat that was surely the epitome of that special brand of courage which all F.E. observers had to possess. The observer had to stand up, facing backwards, with the upper edge of the cockpit coaming below the level of his knees, and only his hold on the guns and their mountings to save him from falling overboard. Safety belts were not provided—and there were no parachutes.

A former observer of No. 11 Sqn, writing in 1937, described his feelings about the F.E.2Bs armament in these terms :—

> "Anyone who has fought from the open nacelle of an F.E. will know how completely unprotected and exposed he felt first time up.
>
> "My flight commander took me over the lines to show me round and instructed me very forcibly to move about and handle the guns. One, by the way, faced forward and the other was fixed on a telescopic mounting, which necessitated standing on a locker at the back of the nacelle and firing over the top plane, holding on as best one could.
>
> "Nothing, however, would induce me to leave the floor on which I was sitting. I simply felt too scared to move.
>
> * * *
>
> "Almost at once I saw three scouts diving towards us, and not knowing much about Hun types blissfully imagined they were British.
>
> "A staccato rat-tat-tat-tat soon dispelled the illusion.
>
> "The instinct of self-preservation is strong and it didn't take long for me to realize that if I didn't want to be cold meat I should have to do something about it, and I was up on that locker at the back like a flash."

That officer had no need to be ashamed of his emotions. Only too often did his brother observers pay with their lives for their determination. On October 22nd, 1916, an F.E.2B of No. 18 Sqn escorting a photographic machine near Bapaume was attacked by a number of enemy scouts, but drove them off and turned for home. Three of the enemy returned to the attack, and the F.E.'s observer, Lt. F. S. Rankin, shot one down. The two remaining German machines attacked from behind and Rankin stood up to engage them with the rear gun. He sent one down with a damaged engine, but was almost immediately struck in the head by a bullet and mortally wounded. He fell out of the aeroplane, but his pilot, 2nd-Lt. F. L. Barnard, caught his coat, abandoned the controls and climbed into the front seat in order to pull Rankin back into the machine. Barnard climbed back into the pilot's seat, still under heavy fire from the surviving enemy fighter, and succeeded in reaching the British lines, despite the fact that most of his controls were shot away.

This gallant action of Barnard's is now less well known than his fine pioneer achievements in early British civil aviation. He lost his life at Winterbourne on July 28th, 1927, while testing the Bristol Badminton II in preparation for the King's Cup Race of that year.

Barnard's feat was repeated in "Bloody April" (April, 1917) by Lt. C. A. Parker of No. 11 Sqn. His F.E. was one of six which were attempting to photograph the Drocourt-Quéant switch line on the 21st of that month, when they were attacked by Richthofen's Staffel 11. In the fight Parker had most of his controls shot away and had to hold on to his wounded observer to prevent him from falling out of the machine.

As enemy scouts of higher performance appeared, the F.E.s found themselves attacked from the rear more and more frequently, but a check was given to the enemy's depredations when the "roundabout" fighting tactics were introduced by the Fees. When a formation was attacked, the F.E.s flew round and round in a circle, so that each machine could protect the tail of the one in front. The dangerous blind spot which was inseparable from the machine's pusher layout was thus eliminated. Disposed in this fashion an F.E. formation could be exceedingly formidable, but these tactics had the disadvantage that, if a combat were prolonged, a westerly wind could drift the whole formation over to the enemy side of the lines.

But in their day the F.E.s could fight. In the afternoon of the day of Immelmann's death, three Fees of No. 25 Sqn were attacked by seven Fokkers near Arras. One of the F.E.s was shot down, but the two surviving machines, flown respectively by Capt. W. A. Grattan-Bellew and 2nd-Lt. J. L. P. Armstrong, engaged the enemy to such good purpose that each F.E. accounted for a Fokker. The five remaining German machines retreated incontinently. Grattan-Bellew won the M.C. for an action fought a few days later, when five F.E.2Bs were attacked by eight Fokkers. He and his observer shot down two of the enemy, and Grattan-Bellew saved his formation by his resolute handling of his machine.

The F.E.2B was somewhat underpowered with the 120 h.p. Beardmore, and the more powerful version of that engine was fitted to the later machines. This delivered 160 h.p., but was somewhat refractory at first, and many forced landings were caused by engine trouble. This was an unwelcome change, for the 120 h.p. Beardmore enjoyed a reputation for reliability.

An early mark of the Rolls-Royce Eagle was also fitted, but in this form the machine was re-designated F.E.2D. The first R.F.C. unit to have the F.E.2D was No. 20 Sqn, which was re-equipped with the type in June, 1916. One of the first F.E.2Ds to go to France was delivered intact to the enemy, the pilot having lost his way in bad weather, so it could not have been a surprise to German pilots when they encountered F.E.s with a greatly

The F.E.2 Series . . .

improved performance. The machine was still not exactly fast, even with the 250 h.p. motor, but it could be (and frequently was) remarkably pugnacious, especially when armed with one or two fixed Lewis guns in addition to the observer's guns and flown in single-seat scout fashion, with the pilot using the fixed armament as the principal means of offence.

Compared with that of the less powerful F.E.2B the F.E.2D's career was rather brief. An opinion seemed to exist that the excellent Rolls-Royce engines were not used to the best advantage in the F.E. airframe, so the type was withdrawn from service to release the Eagles for other uses.

However, the F.E.2D earned a place in history as the machine on which was won the only Victoria Cross awarded to a N.C.O. pilot during the 1914-18 war. On January 7th, 1917, the F.E.2D flown by Sgt. Thomas Mottershead of No. 20 Sqn was attacked by several enemy scouts, and in the course of the fight the F.E.'s petrol tank was struck and burst into flames. Nothing that Mottershead's observer (Lt. W. E. Gower) could do was of any avail, but, enveloped in flames, the gallant N.C.O. retained control of his machine and brought it down to a safe landing. Sgt. Mottershead succumbed to his burns, but, as was said in the citation in the *London Gazette* of February 12th, 1917, " . . . his wonderful endurance and fortitude undoubtedly saved the life of his observer."

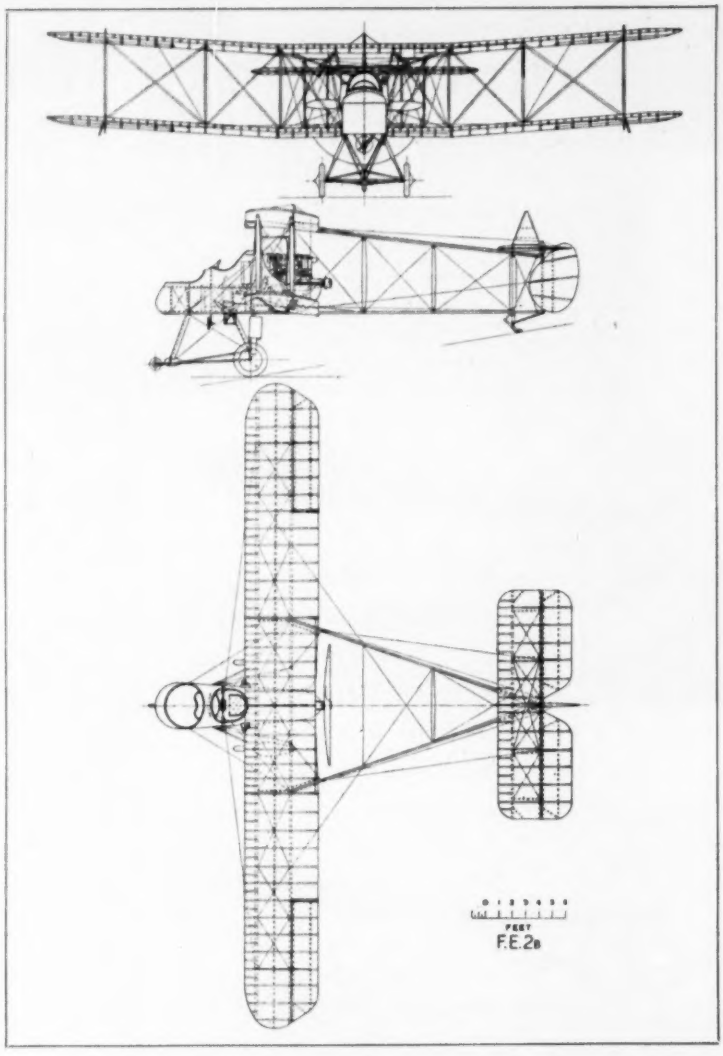
Every possible extra mile per hour was squeezed out of the F.E.s. The main feature of the design which could be modified to reduce drag was the undercarriage, which, on both F.E.2B and 2D alike, was the sturdy but cumbersome oleo structure with a small auxiliary nosewheel to prevent nosing-over on landing. This nosewheel was frequently removed, particularly on F.E.2Ds (in No. 25 Sqn this was done immediately a new machine was received from the aircraft park) and the radius rods were attached to the V-strut pick-up points. This refinement added some 3 to 5 m.p.h. to the F.E.'s top speed.

Somehow or other, an idea has gained much credence that the F.E.2D had a plain vee undercarriage, by which the type could be positively identified. This was not so, and the only feature which clearly distinguished the F.E.2D from the F.E.2B was the large flat radiator mounted above and behind the pilot's cockpit. The plain vee undercarriage almost always denoted a night-bombing F.E.2B, and seems also to have been used on the F.E.2C.

The F.E.2C was a special night-fighter conversion in which the positions of pilot and observer were reversed in order to give pilot the best possible forward view for night landings. Only two were built. One was used by No. 100 Sqn, and an F.E.2C (presumably the other) was on the strength of No. 25 Sqn on July 1st, 1916.

As the year 1916 drew to its close the F.E.s began to be outclassed by the fast new Albatros D.I and Halberstadt D.II, which came into service with the opposing Jagdstaffeln in increasing numbers. By the spring of 1917 the Fees were almost completely eclipsed, though as late as July 6th, 1917, Manfred von Richthofen was brought down wounded by the observer of an F.E.2D of No. 20 Sqn. Lt. A. E. Woodbridge, the observer concerned, and his pilot, Capt. D. C. Cunnell, had accounted for four German scouts in the fight before Richthofen entered it, only to run into a well-aimed burst from Woodbridge's Lewis.

After its withdrawal from daylight operations, the F.E.2B gave sterling service as a night bomber. It was, in fact, the R.F.C.'s standard night bomber until the Handley Page O/400 came into general use. Night after night the F.E.s trundled over the enemy's lines with their loads of bombs, even disturbing the great Richthofen in his lair at Douai. On the night of April 5th/6th, 1917, and again on April 6th/7th, No. 100 Sqn paid their respects to the Red Knight and caused considerable damage to his unit.



This same squadron received two specially modified F.E.2Bs in April, 1917. These machines were each armed with a one-pounder quick-firing gun and were used for night ground-attack work. Trains made good targets for these guns, but the weapons were not over-reliable and faults could not be rectified in the air. Many expeditions had, therefore, to be abruptly and prematurely called off long before ammunition was exhausted. No. 102 also experimented, in 1918, with an F.E.2B carrying a one-pounder gun as a means of extinguishing searchlights. The recoil of this gun was so great that it used to snap the engine holding-down bolts, and an added hazard was the risk of the empty shell-cases blowing back into the airscrew.

When the Independent Air Force was formed on June 5th, 1918, one of the five original squadrons was No. 100, still flying its faithful Fees. This unit did not begin to re-equip with Handley Page O/400s until August 13th, 1918, but the F.E. remained in service with other units right up to the time of the Armistice.

Enemy balloon-barrages were one of the hazards which had to be faced by the night bombers, even in the first Great War, and an F.E.2B of No. 100 Sqn had the doubtful distinction of being one of the only two authenticated victims of this form of German

MESSIER

Semi-Articulated Landing Gear

The semi-articulated undercarriage is particularly suited to the needs of aircraft where there is insufficient length available for a normal telescopic leg, and where the weight penalty of a fully articulated unit cannot be accepted.

BRITISH MESSIER LTD. · GLOUCESTER

The aeroplane

The de Havilland Comet. The first jet airliner ever to enter scheduled service—on the 6,000 mile London-Johannesburg B.O.A.C. route. In service less than three years after its first test flight. Broke many point-to-point speed records during experimental period. Four de Havilland Ghost engines; span 115′, length 93′.

the pilot

John Cunningham, D.S.O. and 2 bars, O.B.E., D.F.C. and bar, joined de Havilland when 18 years old in 1935. A notable career in R.A.F. from 1940 to 1945 included commanding 85 Squadron (Mosquitoes) 1943-44, and Group Captain Ops. at H.Q. 11 Group. Later service over battle areas after D-day, and against flying bombs. Has worked on the Comet as Chief Test Pilot since the first plywood mock-up days, and has flown hundreds of hours in Comets. Says he has "had very good service from Shell and BP".

SHELL and BP Aviation Service

During its period of test the Comet relied upon the skilled efficiency of Shell and BP Aviation Service—the sort that you too can enjoy at any of the major aerodromes in Britain.

SHELL-MEX AND B.P. LTD., Shell-Mex House, Strand, London, W.C.2

Distributors in the United Kingdom for the Shell and Anglo-Iranian Oil Groups

The F.E.2 Series . . .

anti-aircraft defence. The machine, flown by 2nd-Lt. L. G. Taylor with 2nd-Lt. F. E. Le Fevre as his observer, was returning from a raid on Treves on January 24th, 1918. The F.E. had already been badly damaged and was unable to climb over the balloon-barrage. Inevitably, it struck one of the cables and was brought down, fortunately without causing the deaths of its occupants.

No doubt this incident was one of the main reasons behind the experiments, carried out at Orfordness, with an F.E.2B to which a balloon fender was fitted. This consisted of a long, bowsprit-like boom mounted under the nacelle and projecting some 6ft in front, and from it cables ran outwards and backwards to the outer extremities of short extensions of the front spars of both upper and lower wings. An additional interplane strut was fitted at each wing-tip proper, and the spar extensions were also connected by struts. Capt. Roderick Hill volunteered to fly this F.E. into a balloon cable, and did so. The device was only partly successful; although the cable was deflected by the fender it bit into a wing-tip and caused the F.E. to spin. Hill regained control and landed. The device was never used by the squadrons : it was heavy, and must have reduced the F.E.'s performance to something near vanishing-point, but it had an interesting parallel in the clumsy balloon fenders fitted to some Heinkel He111s early in the recent war.

Home Defence squadrons used the F.E., but it was not an ideal machine for the job, for it had little hope of getting anywhere near a Zeppelin. The nearest approach to a real attack on a Zeppelin was made on March 13th, 1918, when 2nd-Lt. E. C. Morris and his observer, 2nd-Lt. R. D. Linford, flying an F.E.2D of No. 36 Sqn from Seaton Carew at 15,000ft, saw a Zeppelin over Hartlepool at about 20,000ft. Morris coaxed his machine up to 17,300ft, and both he and Linford fired at the airship, but failed to achieve any visible result. They followed the Zeppelin out to sea but eventually lost sight of it in the mist.

Several single-seat conversions of the F.E.2B were made in attempts to improve the rate of climb and ceiling. Some (for example, A.5684) were probably modified by No. 36 Sqn. These had the forward cockpit covered over and a single forward-firing Lewis gun fitted : the tailplane incidence was altered to take care of the displaced c.g. Another conversion, made at Marham and probably the work of No. 51 Sqn, was generally similar but mounted twin fixed guns in the nose. It rejoiced in the nickname of "The Chinese Scout."

Even those F.E.2Bs employed on coastal patrol had their moments. On May 31st, 1918, a coastal F.E. and a destroyer sank the U-boat U.C.49 by the combined means of the aircraft's two 100-lb bombs and the destroyer's depth charges.

This was but another example of the F.E.'s versatility, a versatility which seemed to exist in spite of, rather than because of, the machine's design. Surely the most unusual employment of Fees was the duty which was laid upon No. 101 Sqn on the night of July 4th, 1918. Sixty Allied tanks were assembled under cover of darkness, in preparation for a large-scale attack : the F.E.s were ordered to fly about over the enemy lines so that the noise of their engines would drown the sounds of the tanks' movements.

This last duty seems to typify the F.E.—it was a gallant, plodding, hard-working, but essentially obliging aeroplane, willing at least to try to do whatever was demanded of it. It was essentially a machine of the war, and, like the good old soldier it was, it faded unobtrusively away after the Armistice. One solitary specimen lingered on for a time as G-EAHC, but the F.E. "was ever a fighter"—indeed, the original meaning of the initials of its

A standard F.E.2B with 160 h.p. Beardmore.

F.E.2B with two Lewis guns and searchlight.

F.E.2B with 150 h.p. R.A.F.5 engine.

WEIGHTS AND PERFORMANCE

	F.E.1	F.E.2 (Gnôme)	F.E.2 (Renault)	F.E.2A	F.E.2B (120 h.p.)	F.E.2B (160 h.p.)	F.E.2C	F.E.2D
	lb	lb	lb	lb	lb	lb	lb	lb
Weight empty	—	—	—	—	2,105	2,121	—	2,509
Military load	—	—	—	—	452	520	—	440
Fuel and oil	—	—	—	—	270	396	—	520
Weight loaded	1,100	1,200	1,865	2,680	2,827	3,037	3,037	3,469
Maximum Speed at s. l.	m.p.h. 37	m.p.h. 47.5	m.p.h. 67	m.p.h. 75	m.p.h. —	m.p.h. —	m.p.h. —	m.p.h. 95
6,500 ft	—	—	—	—	73	81	81	93
10,000 ft	—	—	—	—	72	76	—	88
Climb to	min	min	min	min	min	min	min	min
6,500 ft	—	—	—	—	19.5	18.9	—	10
10,000 ft	—	—	—	—	45.5	39.7	—	18.33
Service ceiling	—	—	ft 5,500	ft 6,000	ft 9,000	ft 11,000	ft 11,000	ft 16,500

NOTE: Endurance data available: F.E.2B (120 h.p.), 3¼ hr; F.E.2D, 3hr.

DIMENSIONS

Dimensions	F.E.1	F.E.2 (Gnôme)	F.E.2 (Renault)	F.E.2A	F.E.2B (120 h.p.)	F.E.2B (160 h.p.)	F.E.2C	F.E.2D
	ft	ft	ft in	ft in	ft in	ft in	ft in	ft in
Span	33	33	42 0	47 8	47 9	47 9	47 9	47 9
Length	40	28	30 0	32 3	32 3	32 3	—	32 3
Height	—	—	—	—	12 7½	12 7½	12 7½	12 7½
Chord	—	—	6 4	5 6	5 6	5 6	5 6	5 6
Gap	—	—	—	—	6 3½	6 3½	6 3½	6 3½
Stagger	—	—	—	—	nil	nil	nil	nil
Dihedral	—	—	—	—	4°	4°	4°	4°
Incidence	—	—	—	—	3° 30'*	4° 10'	—	—
					ft in	ft in	ft in	ft in
Span of tail	—	—	—	—	16 11	16 11	16 11	16 11
Wheel-track	—	—	—	—	6 4.4	6 4.4	—	—
Airscrew dia.	—	—	—	—	9 0	—	—	—
Wing Area (sq ft)	340	340	425	494	494	494	494	494

* In second versions, 4° 10'.

Above is the F.E.2C, a night-fighter conversion with the pilot in front. On the right is a single-seater F.E.2B fighter and below is an early F.E.2D (250 h.p. Rolls-Royce Eagle engine).

The F.E.2 Series . . .

designation had long been forgotten, and it was generally regarded as the "Fighting Experimental." But for the F.E. there was not to be one fighting more : its best and last fight was fought before the end of the war.

F.E. Facts and Figures

Power plants.—F.E.2A: 100 h.p. Green; F.E.2B: 120 h.p. Beardmore, 160 h.p. Beardmore, 150 h.p. R.A.F.5 (experimental only); F.E.2C: 160 h.p. Beardmore; F.E.2D: 250 h.p. Rolls-Royce Eagle.

Manufacturers.—The Royal Aircraft Factory, Farnborough, Hants.

Sub-contractors.—Sir W. G. Armstrong Whitworth and Co., Ltd., Gosforth, Newcastle-on-Tyne; The Austin Motor Co., Northfield, Birmingham; The Blackburn Aeroplane and Motor Co., Ltd., Olympia, Leeds, Yorks; The Coventry Ordnance Works, Ltd., Coventry; The Daimler Co., Ltd., Handley Page, Ltd., Cricklewood; D. Napier and Son, Ltd., Acton; The Siddeley-Deasy Motor Car Co., Coventry; Vickers, Ltd., London; G. and J. Weir, Ltd., Glasgow.

Production.—A total of 1,939 F.E.s of all types were built, 248 of which were F.E.2Ds.

Allocation.—F.E.2B: To fighter-reconnaissance duties, 1916-17, 603; to night bombing duties, 395; to Home Defence units, 213; to Training Squadrons, 375. F.E.2D: to Western Front, 189.

Distribution of F.E.s of all types on 31.10.18.—With the Expeditionary Force in France, 220; in transit to and at aeroplane repair depots, 9; with contractors and at aircraft acceptance parks, 68; Home Defence units, 97; training units, 38; various home-establishment units, 87; in store, 44. Total number of F.E.s on charge, 563.

Costs.—Cost of airframe, less engine, guns and instruments: *F.E.2B*: £1,521 13s 4d; *F.E.2D*: £1,540. *Cost of engines:* 120 h.p. Beardmore, £825; 160 h.p. Beardmore, £1,045; 250 h.p. Rolls-Royce, £1,430.

Armament.—*F.E.2* (*Gnome*): One Maxim machine-gun on movable mounting in nose. *F.E.2* (*Renault*): One machine-gun on movable mounting in front cockpit. *F.E.2B*: At least one 0.303in Lewis machine-gun, at first on a bracket mounting in front of the forward cockpit, later on a pillar type mounting. This was usually augmented by another Lewis on a tall pillar type mounting between the cockpits, which could be fired backwards over the top plane. Bombs could be carried by the fighter-reconnaissance version: these were usually 20 lb Coopers. The night bomber version carried 2 x 112 lb bombs or their equivalent. Experimental armament included various installations of one-pounder quick-firing guns, and a pair of Lewis guns coupled to a small searchlight. *F.E.2D*: Usually had the basic two Lewis guns at the nose and between the cockpits, and frequently at least one fixed forward-firing Lewis fired by the pilot.

Service Use.—*F.E.2A*: It seems probable that this type may have seen some service with No. 6 Squadron, R.F.C. *F.E.2B*: *Western Front.*—R.F.C. Squadrons No. 6, 11, 16, 18, 20, 22, 23, 25, 38, 58, 83, 100, 101, 102, 148, 149, "I" Flight of 54th Wing (previously known as Special Duty Flight). *Home defence.*—Nos. 33, 36, 51 and 58. *Home defence and training.*—No. 38 (some dual-control F.E.s). *Night training.*—Nos. 191, 192, 199 and 200. *Coastal patrol.*—Flights attached to R.N.A.S. *Operational training.*—Used at Andover, Stonehenge and Thetford (School of Navigation and Bomb Dropping). *American Expeditionary Force.*—The A.E.F. procured 30 F.E.2B's with 160 h.p. Beardmore engines in August, 1918, for use as night observation machines.

On November 11, 1918, the R.A.F. units still using the F.E.2B were Squadrons No. 38, 83, 101, 102, 148, 149 and "I" Flight. *F.E.2C*: Nos. 25 and 100. *F.E.2D*: *Western Front.*—Nos. 20, 25 and 57. *Home defence.*—No. 36.

Known Serial Numbers.—604 F.E.2 (Renault), 4934, 4957, 4962, 4997, 5364, 5610 (No. 102 Sqn), 5618 (No. 101 Sqn), 5655, 5661 (No. 102 Sqn), 5664 (No. 100 Sqn), 6562 (No. 102 Sqn), 6575 (No. 101 Sqn), 6669, 6927, 6933, 6934, 6937 (No. 25 Sqn)—Manfred von Richthofen's 18th victory, (Jan. 24th, 1917), 6994, 7364 (No. 20 Sqn), 7366 (No. 20 Sqn), A.9 F.E.2D "Presented by residents of the Punjab," A.781 F.E.2B with experimental armament; twin Lewis guns coupled to a searchlight, A.852 F.E.2B of No. 100 Sqn, A.4959 F.E.2D of No. 57 Sqn, A.4997 F.E.2D of No. 25 Sqn, A.5216 F.E.2B of No. 22 Sqn, A.5439 F.E.2B of No. 25 Sqn—Manfred von Richthofen's 27th victory (March 17th, 1917), A.5443, A.5444, A.5446, A.5684 F.E.2B (converted to anti-Zeppelin single-seater), A. 6366, A.6374 F.E.2D, A.6382 F.E.2D —Manfred von Richthofen's 34th victory (April 3rd, 1917), A.6384 F.E.2D, A.6389 F.E.2D, A.6405 F.E.2D of No. 192 Sqn, A.6415 F.E.2D of No. 20 Sqn, A.6469 F.E.2D of No. 20 Sqn, A.6473 F.E.2D, A.6484 F.E.2D of No. 192 Sqn, A.6531 F.E.2D of No. 51 Sqn, A.6555 F.E.2D, B.404 F.E.2B of No. 192 Sqn, B.446 F.E.2B of No. 101 Sqn, B.477, B.1897 F.E.2D, C.4283 F.E.2B, C.9231 F.E.2B, D.9104 F.E.2B, D.9743 F.E.2B, D.9962 F.E.2B, E.7075 F.E.2B, E.7105 F.E.2B of No. 192 Sqn.

INITIATIVE

AIRCRAFT have, before now, taken off with elevator-locks in place, but in most cases the end of the story has been the expected—and short—one. An exception to the rule, and one with a much longer story attached, was related recently by the *Sunday Express* air reporter.

F/L W. J. ("Spud") Potocki, D.F.C.—who is an R.A.F. test pilot and something of a legendary character—was, says the account, to fly an R.A.E. Viking on certain tropical equipment trials between Khartoum and Nairobi. His crew and passengers —six men and a woman, all technical personnel—happened to be nicely distributed so far as c.g. position was concerned, and it was not until Potocki reached the end of the runway that he realized the elevators were locked.

He allowed the aircraft to climb itself away, gained some 5,000ft and then, by using his passengers as a tail-trimmer, levelled-off and flew in a gentle circle over Khartoum.

Using a fire-axe, a crew-member hacked through the rear bulkhead, crawled through and cut a small hole in the tail skinning. Handing over to his second pilot, F/L. Potocki then lashed a sheath-knife to a pole, pushed it out through the hole, and spent two hours sawing away at the control-lock, which was made of hard-rubber.

At last it parted, full control was restored, and Potocki put down safely again at Khartoum.

If it is true—and we have no reason to think it otherwise—this story deserves to go down in aviation history as a true classic of cool resourcefulness, and one reflecting the greatest credit on captain, crew and passengers alike.

EAST AFRICAN OIL SURVEY

A COMPREHENSIVE programme of geological and geophysical surveys in the quest for oil in East Africa is shortly to be started by the D'Arcy Exploration Co., the prospecting subsidiary of Anglo-Iranian, in conjunction with the Royal Dutch Shell, and under licence from the governments concerned.

As a preliminary, an extensive air-photo survey is being undertaken by Hunting Aerosurveys, Ltd., with three aircraft, a Bristol Freighter, a Viking and an Oxford. Operations based initially on Dar-es-Salaam have already started over the coastal area of Tanganyika and coverage will later be made of Zanzibar and the Pemba Islands, and parts of Kenya.

Geological and geophysical ground surveys of various islands off the East African coast will shortly be carried out by an Anglo-Iranian survey vessel and will be followed by further detailed reconnaissances on the mainland.

RANGE

. . . *the long*

Saunders-Roe Princess

Aeroplane photographs

Saunders-Roe Skeeter

and the short of it

SAUNDERS ROE LTD

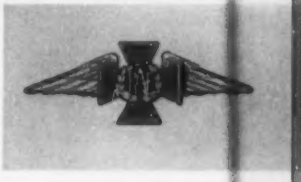
WORKS AT: EAST COWES, ISLE OF WIGHT · EASTLEIGH, SOUTHAMPTON · BEAUMARIS, ANGLESEY

de Havilland Gipsy engines
hold the confidence of pilots
and engineers throughout the
world

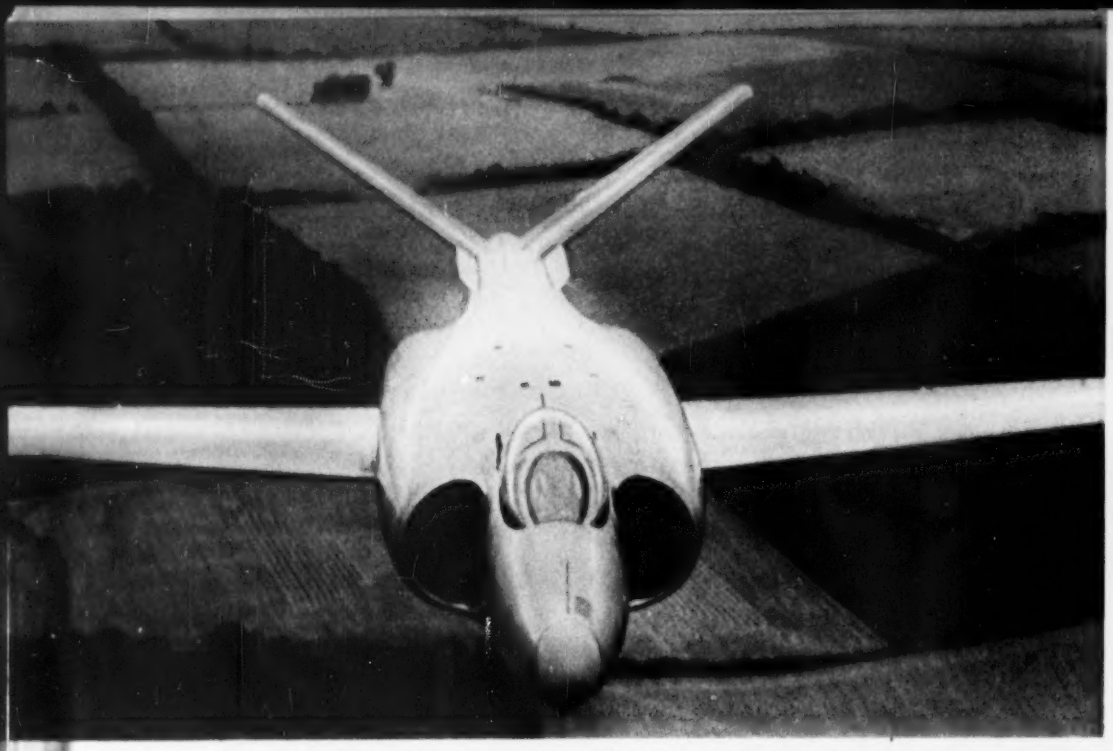
1918

THE PADRE TAKES OVER

SEARCHING our photographic files for illustrations to Mr. Bruce's article on the F.E. series (preceding pages) we came upon the now-famous picture above, showing an R.F.C. padre conducting a Sunday-morning service in France from the gunner's cockpit of a 1918 F.E. 2B night bomber. Almost simultaneously the second photograph arrived in the office: it depicts a U.S. Navy chaplain being set down on the deck of a cruiser by a Sikorsky HO3S-1. We print the two pictures as a tribute to the men in the dog-collars. In the flying Services especially, they have earned the affection and admiration of all ranks.



1952

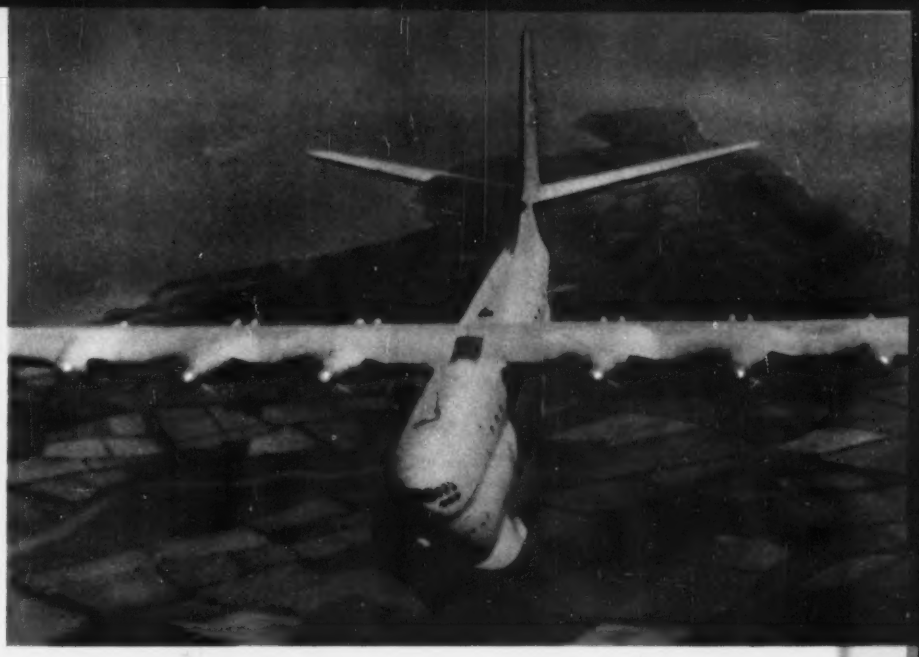


The world's most powerful naval fighter—Vickers-Supermarine's Type 508—shows its gaping Avon-intakes, butterfly tail and fore and aft "spines."

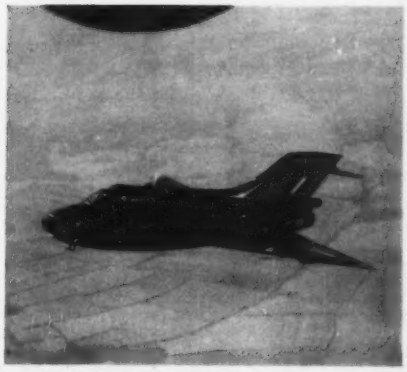
NEW ANGLES

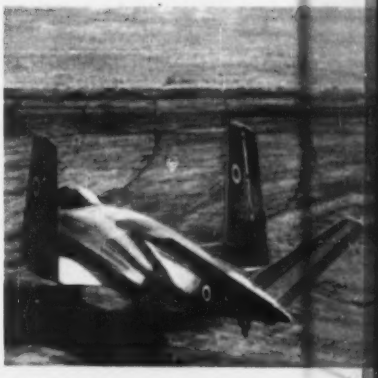
To the Shell Film Unit, whose remarkable record of this year's S.B.A.C. Display was reviewed in "Flight" of November 28th, we are indebted for these unusual pictures of distinguished British aircraft. The large views of the Vickers-Supermarine 508 and Saunders-Roe Princess and the shots of the Bristol 173, Vickers Viscount and the folded "508," are cuts from the actual film; the other views are specially taken "stills." R.A.E. co-operation made the film possible.

The magnificent, Proteus-powered Britannia, in B.O.A.C. livery, slips quietly alongside the photographic Lancaster.



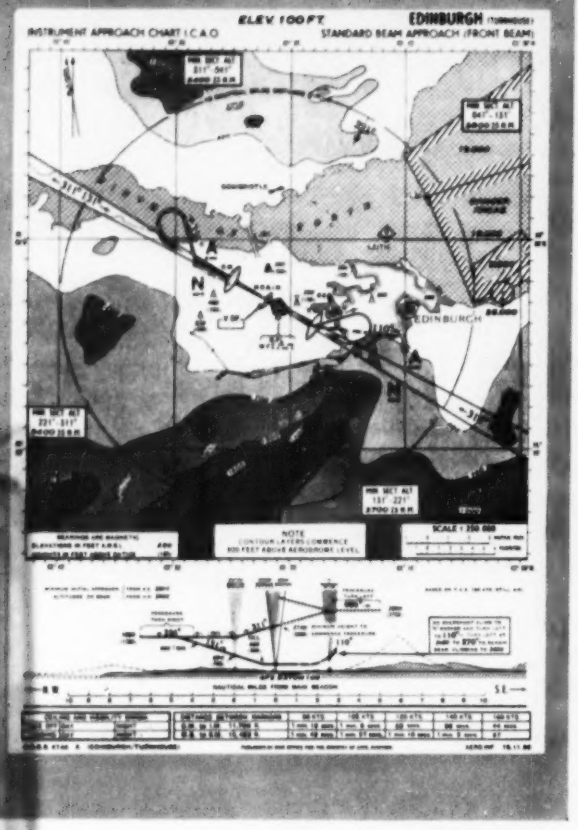
Seldom has the vast bulk of the Saunders-Roe Princess been pictured to better effect than in the close-range study on the right. Below are two of the only existing set of air-to-air pictures of the Boulton Paul P.120 Nene-powered delta-wing research aircraft which was destroyed in an accident shortly before the Farnborough Display. To the right of the all-black P.120 is another view of the Vickers-Supermarine 508, seen taxying out to the runway with folded wings.





By its appearance and performance the Bristol 173 helicopter (two Alvis Leonides), of which a worm's eye view is given below, made an excellent impression on the occasion of its public début. Finally, the first production Vickers-Armstrongs Viscount (four Rolls-Royce Darts) is shown peeling off. This machine is finished in full B.E.A. colours and is expected to complete its acceptance trials by December 18th.

AID TO APPROACH



REPRODUCED here is the first example of a new series of instrument-approach charts produced by the M.C.A. By comparison with the current series, the new type offers two important advantages : it is more easily read and is more economical to produce, being printed in two colours instead of three.

Designed to assist pilots in making an instrument let-down at their destination, such charts are centred on the airport concerned and give an indication of the main radio aids, approach procedures and hazards to navigation, together with a number of references for visual identification; a more detailed picture of the airfield layout is printed on the reverse side of each chart. The original I.C.A.O. specification called for functional use of three colours—subdued black or grey (for topographical and cultural features), magenta (aeronautical information), and transparent blue (water features). Experience with the current series of charts has shown, however, that in congested areas the important aeronautical and procedural information is obscured by the other features, particularly under amber or red cockpit lighting. Contour lines, as used in current charts, are not easily interpreted under such conditions and the consequent number of spot heights tends to become excessive, causing difficulty in picking out the height of the more significant obstructions. The approach-chart specification was modified last year to permit production of simplified two-colour charts designed to overcome these disadvantages.

The use of modern approach-aids has greatly reduced the need for visual reference to the ground and the new chart accordingly sacrifices cultural and hydrographical detail for the sake of clarity. Layer tints instead of contour-lines are used to show height above airfield level. Printed in sepia, which stands out well under cockpit lighting, the five layers represent increases of 300ft, heights more than 1,500ft above airfield level being shown in the darkest tint. Significant peaks are marked by spot heights.

The amount of high ground near Turnhouse made it a suitable site for a prototype chart showing the advantages of the new style of presentation, and this chart was circulated to representative bodies of pilots. Opinions, although favourable, resulted in a number of suggested improvements which have been embodied in the final chart. It is proposed to withdraw the existing charts after an experimental period of six months, during which new-type charts will be available for five different airports; further details are given in *M.C.A. Information Circular* No. 123/52.

INDONESIAN AIR FORCE

By HUGO HOOFTMAN

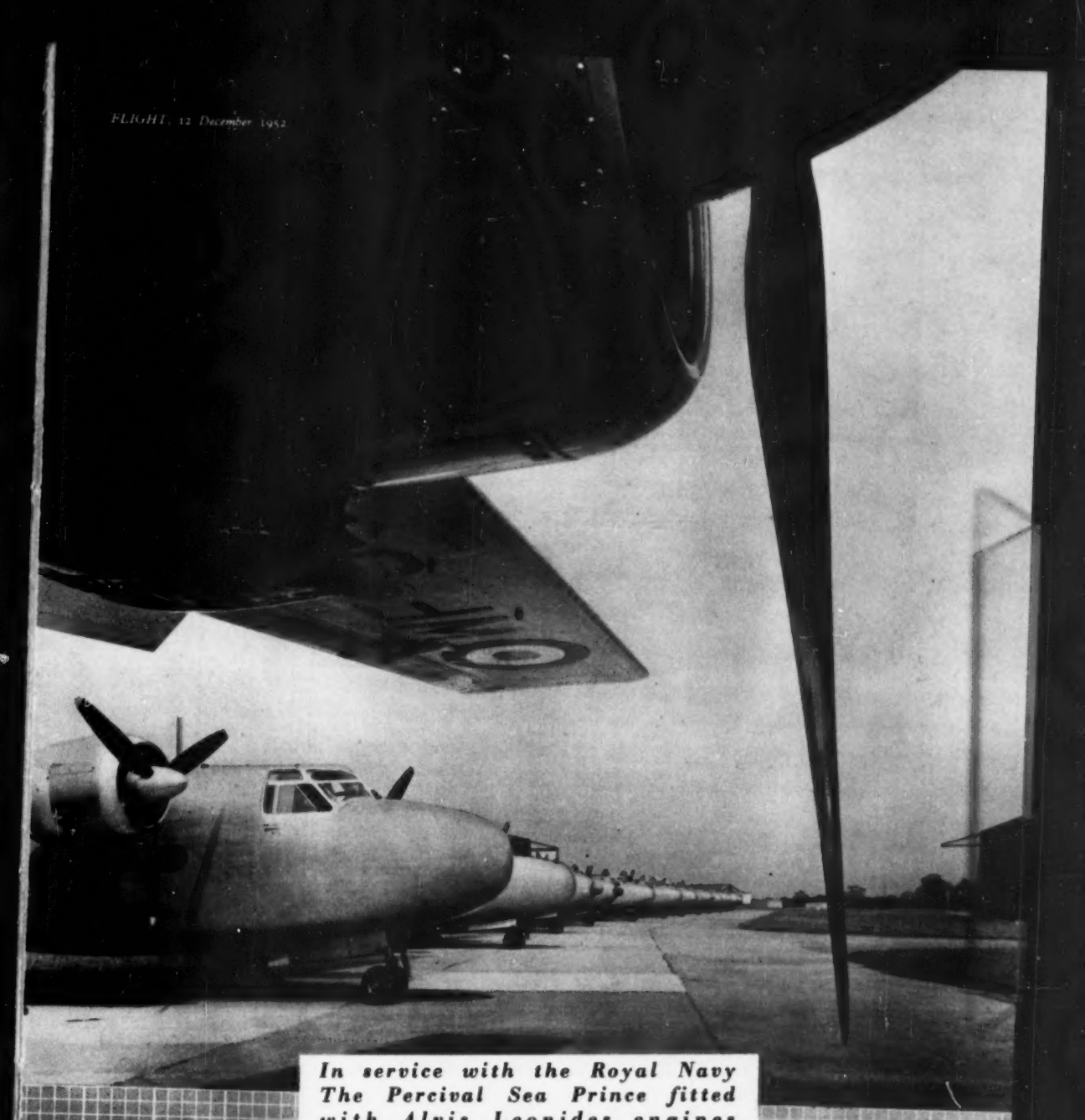
THE Indonesian Air Force was formed under very unusual circumstances, some of which are described here by a Dutch journalist who served in Indonesia with the Netherlands Air Force. Although it was only three days after the Japanese surrender—on August 17th, 1945—that Mr. Soekarno, the president, proclaimed Indonesia a republic, five years were to elapse before the former Netherlands East Indies achieved full independence. During that difficult period a small air force was somewhat painfully built up, mainly with obsolete and unreliable Japanese aircraft, but many of these were captured or destroyed by the Dutch Air Force. The Dutch government had accepted the principle of Indonesian independence but, contending that it was first essential to suppress certain subversive forces inside the republic, twice undertook armed "police-actions"—in July, 1947, and December, 1948. Under the auspices of U.N.O. a peaceful settlement was finally reached and the Republican government regained authority in 1950. Since then some progress has been made in building up both commercial and military aviation. Training of civil technicians and aircrew is in the hands of an I.C.A.O. mission, and Garuda Indonesian Airways, formed jointly by K.L.M. and the Republic, operates a large network of internal and overseas services.

A Dutch mission has played a prominent part in the organization of the Indonesian Air Force.

THE initial task of building up an Indonesian Air Force was entrusted, in August, 1945, to A.Cdre. Suryadarma, the present C.-in-C., who received his military education in Holland before the war. He served for a time with the Netherlands Indies Air Force and received a Dutch award for a wartime attack on a Japanese ship. Another former pilot of the N.I.A.F., Vice-Air Commodore Adisutjipto (later killed in an accident) was appointed head of a flying school.

The first Indonesian aircraft were all Japanese machines taken from a large dump near Djokja (Java), and it was on October 10th 1945, that Adisutjipto made the first flight with a two-seat Nishikoren monoplane. The flying school at Djokja used Willow biplanes of 1933 vintage; R.A.F. pilots who saw them later wondered how the Indonesian pilots ever flew them. However, the Willows were used not only for training but bombing (fitted with two 100 lb bombs under the wings), in company with a number of open-cockpit, two-seat light bombers of the Ida type.

The Indonesian Air Force, which is known as the AURI (Angkatan Udara Republik Indonesia), was established as a separate service independent from the army on April 9th, 1946. When the first Dutch police-action began on July 21st, 1947, the AURI had accumulated about 30 aircraft in flying condition, all of Japanese design; most were destroyed on the ground by rocket-firing Mustangs and Kittyhawk and Spitfire fighter-bombers. The main target was Boegis, near Malang, where several Oscar fighters, Dinah reconnaissance aircraft and Lily bombers were destroyed. Only a few retaliatory attacks were made : on July 29th, when a Sonia dive-bomber made an ineffective strike on Semarang and when some Willows dropped light bombs on Ambarawa and Salatiga. Dutch Kittyhawks took off to intercept the Sonia but, unfortunately, visibility was poor and over Djokja they mistook for their target an Indian Dakota and thereupon

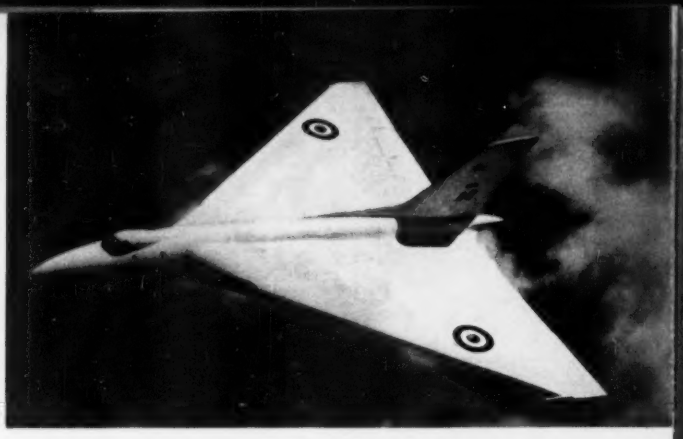


In service with the Royal Navy
The Percival Sea Prince fitted
with Alvis Leonides engines

ALVIS

LEONIDES

ALVIS LIMITED, COVENTRY, ENGLAND



Avro Vulcan

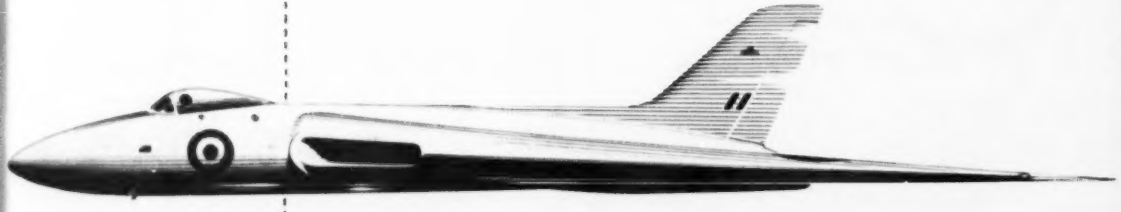
a

rapier

for

Bomber

Command

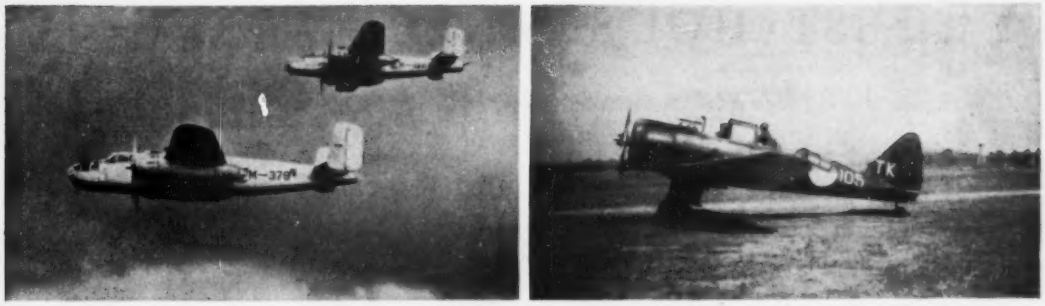


To strike at an aggressor's heart, today's bombing strategy calls for a rapier force of very fast, high flying and manœuvrable aircraft. Such a thoroughbred bombing weapon is the Avro Vulcan, which with a small crew has fighter-like performance and delivers a bigger load faster, higher and further, for less fuel expenditure, than any aircraft anywhere in the world.

A. V. ROE & CO. LIMITED / Manchester

AVRO

MEMBER OF THE HAWKER SIDDELEY GROUP
PIONEER . . . AND WORLD LEADER IN AVIATION



Present and past equipment of the AURI: (left) two B-25 Mitchells with the original Netherlands markings, now replaced by the Indonesian insignia (white rudders and red-and-white squares on the fuselage); (right) one of three Japanese Ida dive-bombers used in 1945.

INDONESIAN AIR FORCE . . .

shot it down. Among the passengers killed were S/L. Roy Hazlehurst of the R.A.F. and W/C. A. N. Constantine of the R.A.A.F.

In December 1947 the Republican Government took the first steps towards building up a transport force, which later became Indonesian Airways. In turn, this company formed the nucleus of No. 2 Squadron of the present AURI. First of all, an Australian Anson (VH-BDY) was chartered, but this crashed while returning to Indonesia after a flight to Siam. All the occupants were killed, including Vice-Air Commodore Perdanakusum, who flew some forty missions with R.A.F Bomber Command during the war.

The first Indonesian-registered aircraft was RI-002, a Dakota owned by an American pilot, Bob Freeberg, who flew for the Republic on secret missions. It made a tour of Sumatra in June, 1948, carrying President Soekarno, who appealed to the populace for money to buy another Dakota. As a result, Dakota VR-HEC was bought from India and registered RI-001. Both Dakotas were used by Indonesian Airways, which also acquired an Anson (RI-004) and a Stinson Sentinel (RI-003). The latter was acquired from an Australian pilot named Cobley, who also flew for the Republic.

The chapter of misfortunes continued, however. The Sentinel vanished on July 7th, 1948, over Sumatra and was never heard of again and three months later precisely the same fate befell RI-002; Freeberg was among the occupants. Two other aircraft used by the Republic were Catalinas RI-005 and 6. The former aircraft is believed to have made several secret landings on Indonesian lakes, carrying weapons for the Indonesian forces; it crashed in December, 1948, during the second Dutch police-action. Cobley, its owner, was among the four occupants killed.

On December 19th there was a large-scale paratroop attack on Djokja and the town was captured in a day. No resistance was offered by the aircraft of the AURI, and once more nearly all were destroyed on the ground or captured.

Hiller 360 helicopters are used for rescue and training duties.

Perhaps the first bright day in the history of Indonesian military aviation was June 21st, 1950, when, after 36 years of service, the Netherlands Indies Air Force ceased to exist. All airfields and aircraft were handed over to the AURI, providing a nucleus for the formation of two squadrons. As mentioned previously, one squadron (No. 2) is a military air transport service based on the earlier Indonesian Airways and equipped with Dakotas; the other (No. 1) is a composite unit equipped with Mustangs, Mitchells and Catalinas, together with a transport flight detached from No. 2 Squadron. No. 3 Squadron, formed in 1951, is an army reconnaissance unit, whose equipment includes Austers and Piper L-4s. Training is carried out mainly with Vultee BT-13s and Harvards. Hiller 360 helicopters are also in service, both for training and research and rescue duties.

A. Cdre. Suryado Suryderma, present C.-in-C. of the Indonesian Air Force.

Under the present AURI organization, the Republic is divided into seven areas, each administered by a separate command. In each area is one main base and three or four stations. Primary flying instruction and training in certain ground subjects is given at Kaljati; conversion and defence training of fighter, bomber and transport crews is carried out at Andir; all tactical training is given by the squadrons. AURI is also responsible for training paratroops.

Indonesians are among the many foreign pilots being trained by the U.S.A.F., and a further link with the U.S.A. is the fact that some Americans are still among the many non-Indonesian pilots serving with AURI.

FORTHCOMING EVENTS

Dec. 12. Junior Institution of Engineers: "The Air and the Future," by A. Cdre. F.R. Banks, C.B., O.B.E., F.R.Ae.S., M.I.Mech.E.
Dec. 13. British Interplanetary Society: "Guidance and Control of Missiles," by J. Humphries, B.Sc.(Eng.), A.M.I.Mech.E., A.F.R.Ae.S.
Dec. 13. British Interplanetary Society, Birmingham Branch: "Fundamentals of Nuclear Energy Generation," by Dr. D. C. Leslie, M.A.
Dec. 16. R.Ae.S. Graduates' and Students' Section: "An Introduction to Aircraft Vibration," by D. J. Mead, D.C.Ae., Grad. R.Ae.S.
Dec. 16. R.Ae.C.: Film Show, Londonderry House.
Dec. 17. Institute of the Aeronautical Sciences, New York: Sixteenth Wright Brothers Lecture.
Dec. 17. Aircraft Recognition Society: Brains Trust.
Dec. 18. R.Ae.S.: Full-day Discussion on "Fatigue."
Dec.19-20. Institution of Production Engineers: Conference on Problems of Aircraft Production.
Dec. 20. British Interplanetary Society, Manchester Branch: "Rocket-motor Testing," by D. Hurden, B.A.
Dec. 20. Southern Aero Club: Rum Punch Dance.
Dec. 30. Plymouth Aircraft Recognition Society: Meeting.
Jan. 3. British Interplanetary Society: "Planetary Engineering," by E. Hope-Jones, M.A.(Cantab.), F.R.A.S., A.M.I.Mun.E.; "Landing on Airless Planets," by R. A. Smith.
Jan. 17. Aircraft Recognition Society: Sixth All-England Recognition Contest.

TEST-HOUSE SILENCING

Methods Employed on the Olympus Test-beds at Bristol

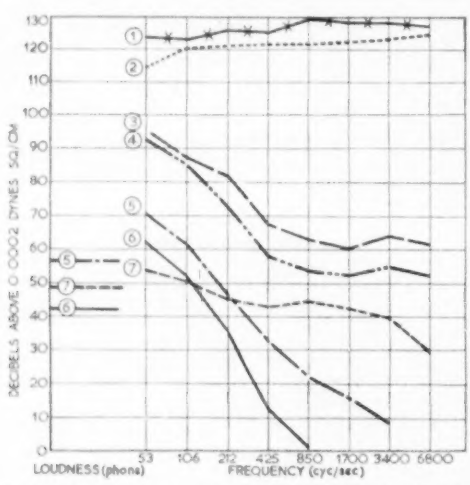
AS a nation we seem to be unusually sensitive to noise, particularly that due to machinery. It is even said that at a meeting of the British Noise Abatement Society one member, who had been annoyed by some test-beds, complained that he could still hear them even though he had moved several miles away—when he awoke at night and *listened very carefully*. But complexes of this nature should not mask the fact that continuous engine noises constitute a serious menace, the elimination of which has already demanded much capital expenditure and is becoming increasingly difficult.

The measurement of sound is usually effected by determining the pressure-rise above a reference of 0.0002 dynes/sq cm, the answer being expressed in decibels. Since these pressure levels are unrelated to the loudness as experienced by the human ear, the noise level can be related to pitch with a bias towards frequencies to which the ear is particularly sensitive; this weighted result is measured in phons, and one phon is equivalent to one decibel at 1,000 cyc/sec.

The noise emitted by a turbojet mainly comes from the intake and the jet nozzle, and the entirely different character of these two sounds poses a severe problem to the acoustic engineer. The intake noise is generally high-pitched, while the jet noise arises from shock-wave turbulence, and contains a wide range of frequencies. The accompanying spectrum shows a typical result for a turbojet, and demonstrates the random nature of the sound distribution, which contrasts with the fundamental-frequency sound spectrum of a piston engine. The turbojet noise frequency is broadly dependent upon r.p.m., and the intensity often varies with the jet velocity at perhaps the seventh or tenth power of the engine speed. Silencing can, therefore, be no more than a compromise.

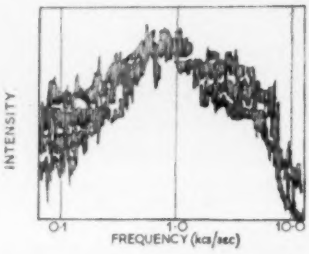
There is no shortage of satisfactory sound-absorbent materials, but the choice for turbojet test-house installation is limited by considerations of temperature and air blast. The following is an account of the silencing methods employed by Cementation (Muffelite), Ltd., of 39, Victoria Street, London, S.W.1, on the Bristol Aeroplane Company's twin test-house designed for turbojets—particularly the Olympus—with thrusts in excess of 10,000 lb.

Since the water supply was restricted, air cooling was chosen, except for possible afterburner runs. It was estimated that an entrained airflow of four to five times that passing through the engine would be needed to avoid thermal damage. The cooling air enters through splitter panels placed both above and below the engine, both intakes being separated from that feeding the combustion air. The general arrangement of the test houses was clearly shown in *The Quest for Power*, published in *Flight* of May 9th last. A model to one-twenty-fourth scale was built for hot-air flow tests and proved to be of great value. One result from the model was the enlarging of the lower cooling-air intake.



Results obtained with an octave-band analyser on the intake side of the Olympus test-houses. The measuring stations were: (1) diffuser chamber between jet-pipe and venturi mouth; (2) engine chamber; (3) just outside engine intake; (4) 33yd from intake; (5) 450yd from intake; (6) 900yd from intake; and (7) normal daytime background-noise level.

Turbojet noise covers the whole range of frequencies from subaudible to ultrasonic in a very haphazard manner.



The engine is mounted slightly above ground level, and the control room is still higher, between the upper and lower cooling intakes; engineers thus profit from the silenced intake and can enter the test chamber without being embarrassed by a large airflow. The engine exhausts into a steel venturi which is followed by a long, steel, trolley-mounted diffuser. Model tests showed that a mass-flow ratio of seven or eight could be expected, the mixing taking place within the diffuser.

Hot flow tests indicated that the splitters would withstand velocities of 140ft/sec, and temperatures of 500 deg C, both of which were considerably greater than the expected values. It may thus be possible for engines considerably larger than the Olympus to be tested in these installations. The main structure of the tunnel enclosing the diffuser consists of monolithic concrete slabs 12in thick, which are pin-jointed to the floor to allow differential expansion. The concrete surface temperature is kept to 75 deg C by lining with a 4in thickness of mineral wool covered by corrugated aluminium reflector panels.

The principle adopted for the silencing shutters is to conduct the stream between a series of acoustic splitter panels and round four fairly sharp bends. By careful design, the depression due to flow drag has been kept to 2in of water. The accompanying performance curves show the silencing achieved on the inlet side of the Bristol test houses. The curves give the sound pressure in decibels for a number of octave bands, while the plotted values on the left of the illustration show the equivalent loudness in phons. The measurements were made with the engine running at full power without an afterburner. Structure-borne sound and vibrations are also met in a small way with gas turbines, and the Olympus test house carries the engine on a concrete block insulated by Elascor cork mats.

Engine test-house silencing requires team work between the engine designer—who wants stable conditions for his engine so that reliable results can be reduced to a standard; the architect—who is interested in providing a durable structure to the engine designer's requirements; and the acoustic engineer—who reconciles the requirements of the preceding engineers with his own job of alleviating a nuisance. The Cementation company stresses that, although it is possible to silence an existing test-house, the result will be far less satisfactory and more expensive than if the silencing were undertaken from the start of design.

AN OLD TIMER'S LECTURE

WELL-KNOWN as manager of the aeronautical department of the General Electric Co. Ltd., Mr. Frank Buckell, A.F.R.Ae.S., A.F.I.Ae.S., recently gave a lecture, illustrated by a film, to the company's Model Engineer and Amateur Radio Societies.

Mr. Buckell began his aviation career as an apprentice in the original Sopwith Aviation Co., and joined G.E.C. in 1922. His talk covered various aspects of aircraft operation from the old "stick-and-string" days up to present traffic-control problems at such places as London Airport, and included explanatory material on typical navigation and landing aids.

The film, taken whilst Mr. Buckell was travelling from England to Africa on one of the early proving flights of the Comet, provided a remarkable demonstration of aviation progress since 1914.

Mr. Churchill on Defence Production

A PRONOUNCEMENT of particular importance to the aircraft industry was made by the Prime Minister in the House of Commons on Thursday of last week. In a statement on the defence programme, he said that certain aspects of production were to be curtailed, and that it was the Government's intention "somewhat to reduce" the production of aircraft types now in service while continuing to press forward as rapidly as possible with the introduction of the newer and still more advanced types.

Mr. Churchill began by recalling that during past months the Government had been engaged on a thorough review of the defence programme in all its aspects. This review, which was still in progress, must take fully into account the results of the forthcoming Ministerial meeting of the North Atlantic Council.

The Government's conclusions would be fully set out in the defence White Paper for 1953 which, in accordance with previous practice, would be issued in February. Certain decisions had, however, been made affecting the defence production programme and these must be put into effect now if they were to produce the desired results.

We had made it clear at the Lisbon meeting of the North Atlantic Council that our ability to carry out our programme in full, and to make our contribution to the forces of NATO, depended on solving our financial and economic problems, and especially the balance-of-payments problem. In spite of successful measures which the Government had taken to strengthen our financial position, these problems were not yet solved—and that was an important, though not decisive, factor in determining the magnitude of our defence effort. It must be remembered that our efforts had to provide not only for the defence of these islands and for our contribution to common defence within NATO but also for our world-wide commitments where we were heavily extended.

The defence budget for the current year amounted to £1,462m, of which something under £600m was for production. To this must be added certain supplementary estimates to which the Chancellor of the Exchequer had recently referred. If the three years rearmament programme drawn up by the late Government had been carried through in full, expenditure on defence at end-1951 prices would have been, in the present financial year, over £1,650m and would have risen in 1953 to more than £1,800m. Within these totals expenditure on production would have been over £725m this year and over £850m next year. Moreover, much of this increased burden would have fallen on the engineering industry on which we depended so much for the vitally needed expansion of our export trade.

The Government had, therefore, decided that any substantial rise above this year's high level of expenditure on defence production must be prevented. Some curtailment must now be made, and this would—to some extent—involve the cancellation or modification of contracts already placed. Firms concerned would be fully informed of these changes by the production Departments, and the reductions would, so far as possible, be brought about by spreading deliveries of equipment over a longer period.

The effect would be to prevent further increases in the amount of labour and materials used for defence production rather than to reduce the total of those resources now devoted to this purpose. It would, however, not be possible to solve the problem entirely by spreading deliveries forward into future months or years. This applied in particular to aircraft, and the Government intended somewhat to reduce the production of types now in service, although pressing forward as rapidly as possible with the introduction of the newer and still more advanced types. In view of progress in the medium bomber, they were able to curtail, to some extent, earlier plans for re-equipment with light bombers.

The changes which were being made would not have any serious effect on industry as a whole, but they might well cause local difficulties. Happily these difficulties were being partially alleviated by the orders being received for defence equipment from our NATO Allies, the Commonwealth, and other friendly countries. These would not only contribute to the security of the free world, but would also help to maintain the war potential of British industry and help the balance of our exports.

Mr. Churchill said he would like those firms, large and small, who had given such ready help by taking on rearmament work when they already had full order books, to know how much the Government valued their co-operation and to understand with what regret the Government now had to ask them to adjust their plans. He was sure they would not be deterred by any disappointment of this kind from continuing to do their utmost, whether as employers or workers, to provide the fighting services with the equipment they needed.

These decisions had been taken in the knowledge that it was on a satisfactory development of our economic position, and particularly, our balance of payments that the maintenance of our future defence effort must depend. But they in no way implied any weakening of the Government's resolve to carry through a defence programme which would enable this country to defend itself, to fulfil its obligations overseas and to take its full share, militarily and industrially, in the common effort of NATO.

POINTS FROM THE STATEMENT

CURTAILMENT of defence orders must, to some extent, involve cancellation or modification of contracts already placed.

•

These reductions will, so far as possible, be made by spreading deliveries over a longer period.

•

The Government intends "somewhat to reduce" production of aircraft types now in service, but to press forward with the introduction of newer and still more advanced types.

•

Progress with medium bombers will permit some curtailment of earlier plans for re-equipment with light bombers. [It is to be assumed that the Valiant and Canberra, respectively, are the types which Mr. Churchill had in mind.]

•

"Local difficulties" caused by the production cuts will be partially alleviated by orders from the NATO countries.

•

The changes imply no weakening of the Government's determination to carry through a defence programme that will enable the country to defend itself and to fulfill its overseas and NATO obligations.

The Prime Minister Questioned

MR. ARTHUR HENDERSON (Lab., Rowley Regis and Tipton), in the exchanges that followed, asked whether the Prime Minister could state the percentage reduction in the projected front-line strength of the Royal Air Force under the three-year programme which would follow as a result of the decision of policy to curtail aircraft orders.

Mr. Churchill replied that he could not answer this question in a detailed way without notice. He nevertheless observed that sometimes it was better to slow down the production of weapons which were being superseded by newer and better types in order to be more ahead a little later on, and the fact that we felt able to do so indicated on the whole that we did not think the worst emergencies we might have to face had approached any nearer to us.

MR. EMANUEL SHINWELL (Lab., Easington) asked if the curtailment in defence production meant that those firms who had to forgo orders already placed would have an opportunity of producing for export. Mr. Churchill said that every effort was made to dovetail these arrangements and utilize labour not immediately needed for defence purposes for the export trade; but some gaps could not be immediately filled.

Mr. Shinwell then declared that if we were to avoid further unemployment in the country, particularly among skilled workers and semi-skilled workers, it would be necessary to arrange speedily for a switch-over from defence production to civilian production. He wondered if the Government were going to spend more this year than was contemplated by the Labour Government last year when they produced their defence programme, and also whether they were curtailing expenditure on defence production or increasing it. Was the increase in the price level retarding the defence programme, or was it some other reason?

Mr. Churchill replied that if the three-year rearmament programme of the late Government had been carried through in full, considerable heavy commitments would have had to be undertaken by Parliament. One of the important causes was the rise in prices, but that was not the only cause. As production got on the move, there was an acceleration and expansion, and very often things were achieved on a much larger scale at an earlier moment than estimated. But, broadly speaking, if the Government had gone on with the programme they found on assuming office there would have been considerably heavier expenditure to meet, and it might have affected the balance of payments adversely. He had no doubt that the late Government, if confronted by the present situation, would have adopted the same adjustments and curtailments to the programme as were now contemplated.

MR. HAROLD WILSON (Lab., Huyton) asked over how long the original £4,700m programme would be spread, whether over two and a half, four, or five years, and how much increase in engineering exports and capital investment for home industry would result from the diversion to those purposes of capacity previously earmarked for defence.

Mr. Churchill replied that the original £4,700m programme carried with it three years of maintenance. Now it had spread over five years, with new maintenance charges running each year, and in addition a rise in prices. If a fourth year was included, it might well be over £6,000m.

MAJOR E. A. LEGGE-BOURKE (Con., Isle of Ely) was assured by Mr. Churchill that our forces in Korea and Malaya would have first call upon the supply of munitions of war.

JET TRANSPORTS: U.S. IDEALS

BROAD specifications for turbine-powered aircraft have recently been published in a report prepared on behalf of the U.S. airline operators and intended as a guide to manufacturers. The report is titled *Design Recommendations for Turbine Powered Aircraft*, and was drawn up by the Air Transport Association of America. In addition to recommendations on specific points of design and manufacture, lines of future investigation are suggested which add considerably to the immediate usefulness of the report, although it appears clear that, with this country's increasing operational experience of existing turbine aircraft such as the Comet and Viscount, modifications to the operating requirements quoted are probable, and further information on operating costs will become available. In view of the widespread interest in the attitude of U.S. operators towards turbine-powered transport aircraft, the report's main recommendations are summarized below.

Passenger capacity of the aircraft should be 70-80, using four-abreast seating, and the cargo provision 11 cu ft per passenger. The interior diameter of the fuselage, constant along the passenger cabin, should be approximately 128in, permitting five-abreast seating for tourist operation; and the fuselage height should be at least 80in.

In still air at I.C.A.N. + 30 deg F, the runway length required for landing, at maximum landing-weight, should not exceed 5,500ft at sea level. The aircraft should be licensed to take off from a 5,500ft runway at sea level at that weight which would permit a 2,000-mile flight at maximum recommended cruising speed, terminating in a maximum-weight landing. For a 3,200-mile flight, the take-off distance is 7,500ft. Maximum recommended cruising speed should be at least 550 m.p.h. at optimum cruising altitude and power and at average operating weight.

The maximum range for turbine-powered aircraft will probably apply to three types of service: one-stop continental, non-stop continental, and international long-range. It is believed that one basic type of aircraft could be evolved which would be suitable for both transcontinental and international service without undue economic penalty; indeed, the aircraft should have the widest possible useful range.

The direct operating cost per ton-mile should not be greater than the present cost of currently operated transport aircraft in similar service.

The aircraft should be equipped with a self-contained air-conditioning system to provide a comfortable environment for the passengers and crew at all times. All areas occupied by crew or passengers should be pressurized to a maximum differential working pressure of ten pounds per square inch. At all altitudes up to the maximum cruising height, a cabin altitude of not greater than 8,000ft should be obtainable, and proper functioning of the pressurization system should not be impaired by the failure of one power plant. The temperature-control system should be capable of automatically maintaining a uniform cabin temperature of 75 deg F with an outside air temperature ranging from that temperature to − 80 deg F in flight, and to − 20 deg F for ground operation. The cooling system should be capable of maintaining an average air-temperature inside the aircraft at least 15 deg below an outside temperature of 100 deg F during unpressurized sea-level flight or while on the ground with engines turning at taxying r.p.m.

No fuel should be stowed in the fuselage. Under-wing centre-point fuelling for each wing should be provided as the primary means, with over-wing provisions for emergency use.

Elements of the undercarriage should have dual wheels, but the installation of more than two wheels on one axle would be undesirable. The geometry of the landing gear should be such that the static weight of the aircraft would prevent collapse of the gear. The aircraft should be certified for landing with a cross-wind component of 40 m.p.h.

It is imperative that the engine installation should, in comparison with those of existing transports, increase the safety of the aircraft in the matter of fire-risk. An engine fire should not jeopardize the primary structure, adjacent engines, nor aircraft and engine controls. Consideration should be given to the use of engine power as an emergency brake. The power plants should be so installed that any fire occurring therein would be inherently contained, and a fire-detecting device superior to those in common current use should be developed. The use of fire-resistant materials, shut-off valves at the fuel tanks, explosive fire-suppressant systems, and pneumatic systems rather than hydraulics, should be considered.

Protection should be provided over the critical areas of the entire aircraft, and over its entire operating-altitude range, against what is currently defined by the N.A.C.A. as moderate ice. Flight characteristics and controllability should not be affected by ice during any phase of take-off, climb, cruise or landing, nor should ice accumulation cause a speed penalty greater than 20 per cent.

Control-system power boost might be acceptable should aerodynamic balance be inadequate to meet control-force requirements, but systems should be designed to provide control "feel" at least equivalent to that provided in present large transports.

Since pressurization is of extreme importance in high-altitude aircraft, it is mandatory that higher standards of structural reliability than in current pressurized aircraft be provided. Extreme care must be exercised in detail design and in the installation of pressurization equipment to eliminate almost entirely the possibility of pressurization failure.

Vertical, upward acceleration of the fuselage should not exceed 29 at maximum landing weight when entering a sharp-edged gust of 40 ft/sec at the cruising speed of the aircraft. Gust-alleviation should be accomplished preferably by means of appropriate aerodynamic and structural design.

No passenger-seating restrictions due to balance considerations should ensue for any reasonable combination of passenger, cargo and fuel loads, and ballast should not be required.

The engines should be capable of ground-handling the aircraft as far as taxying is concerned, with or without steering, but consideration should be given to the use of an auxiliary power unit to render the aircraft entirely independent of any external sources of power supply at any time. Suitable means of auxiliary power might be studied to permit taxying from the ramp to the junction of the taxiway and runway at a minimum speed of 20 m.p.h., and also to supply the power to start the engines.

The aircraft should be designed to have virtually no vibration and a sound level much less than is currently accepted. Particular attention should be given to the avoidance or elimination of low frequency vibrations and buffeting arising from aerodynamic phenomena.

The configuration and construction of the aircraft should afford a high degree of protection to the passengers in the case of a crash.

Normal and emergency deceleration should be accomplished by means of devices contained within the aircraft itself, and anti-skid devices should be developed and installed if found practicable. If possible, a device equivalent to reversible-pitch aircrews on reciprocating engines should be developed for turbine power-plants.

Aids and Services

In addition to standard radio and radar equipment in use when the aircraft reaches the prototype stage, provision should be made for airborne radar, pictorial navigation computer, and visual traffic-signal indicator.

As far as possible, the aircraft should be designed to accomplish maintenance and overhaul procedures on a "continuous-line" basis. Equipment installations should be so located that congestion of personnel working on the aircraft is avoided. Members of all units or assemblies should be provided with inspection panels, or removable sections to permit inspection of a maximum of structural parts. Component parts of particular systems should, where possible, be grouped together into "packaged" units.

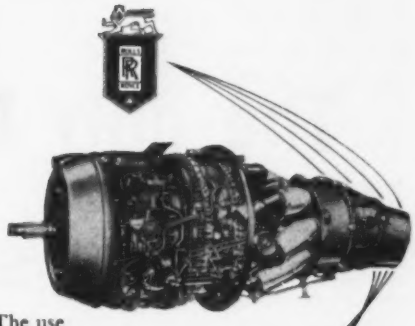
Turbine-powered aircraft should be designed to permit the accomplishment of greater precision in navigation, greater ease of avoiding bad weather and improved reliability for executing instrument landing approaches and the like. The machine should be designed for operation by a flight crew of three. In the conception of the aircraft, the prevention of hazardous conditions, rather than their cure, should be the aim. Provision should be made for good manœuvrability after engine failure, operation at ambient temperatures between − 80 deg and + 160 deg F, quick turn-rounds, and the fitting of suppressed radio aerials, automatic pilot, and non-crazing windows.

Current airline practices should be followed concerning fuel reserves, but an assessment of operating characteristics should be made by manufacturers to assist the airlines in further rationalizing their reserve fuel requirements.

External lighting should conform with the specifications now being drawn up by the airlines and C.A.A., and should be far superior to that fitted to present transport aircraft. The number of connector-type plugs and receptacles in the internal electrical system should be reduced to a minimum, and they should be used only where strictly necessary for operational and maintenance purposes. Hermetically sealed electrical units should be used wherever possible outside pressurized areas, and circuit breakers should combine the desirable features of both thermal delay for circuit starting and magnetic sensing for instantaneous trip on overloads.

30/HT/30

One good trademark leads to another



Every British aircraft gas turbine has rotor blades made of one or another of the Nimonic Series of Alloys. The use of a Nimonic Alloy is an assurance of reliability in any component that must resist stress at high temperatures.

This is the Nimonic 80A turbine blade that rotates in the Dart engines that keep the Vickers Viscount flying

HENRY WIGGIN AND COMPANY LIMITED

Nimonic is a Registered Trade Mark

WIGGIN STREET · BIRMINGHAM · 16

ESSO AVIATION TURBO OIL 35

(Formerly Known as E.E.L.3)

The only lubricating oil in step with jet engine development

Here are the facts about ESSO AVIATION TURBO OIL 35

It is the only synthetic gas-turbine engine lubricating oil in use—and the only lubricating oil which will stand up to the operating conditions of jet engines of enormous thrust now being developed. Esso Aviation Turbo Oil 35 is the outcome of technical research and foresight on the part of Esso lubrication specialists working in close co-operation with engine designers of the British Aircraft Industry.

Why a Synthetic Lubricant?

Any oil that will meet the needs of today's gas-turbine engines must possess quite remarkable properties. Not merely must its viscosity-temperature characteristics be exceptional, but its pour point, flash point, volatility, high-temperature stability and load-carrying properties must all have advantages not possessed in combination by those lubricants formerly used.

The oil must permit rapid engine starting and be pumpable at very low temperatures. At the same time, it must effectively lubricate the critical turbine bearings on both turbo-prop and turbo-jet engines at very high temperatures and have the ability to maintain the perfect condition of the propeller reduction gears on turbo-prop installations.

These requirements are not readily fulfilled, and cannot be met by a mineral oil even of the very highest quality.

But ESSO Aviation Turbo Oil 35 satisfies them all.

A Fully Proved Lubricant

Recognising these facts at an early stage in gas-turbine development, ESSO research teams in Britain concentrated their efforts on producing a synthetic oil equal to these new needs. Their answer is Esso Aviation Turbo Oil 35, a lubricant of proved efficiency, now generally used in all types of gas-turbine engine tested and flown in this country. It is a fact that some of the latest engines would be unable to run at full power without using Esso Aviation Turbo Oil 35.

For this reason Esso Aviation Turbo Oil 35 is invariably used for the high-thrust jet engines now being developed—engines which have never known a mineral oil.

An Economic Investment

A gas-turbine engine uses only a fractional amount of oil per hour (less than one pint, possibly) but E.A.T.O. 35 will enable the engine to maintain high power over long periods without loss of its unique properties. The cost of this lubricant—only 1/25th of the fuel bill—bears favourable comparison with the cost of oil consumed in a piston engine.

Convincing Demonstration

At this year's S.B.A.C. Display, the Rolls-Royce Avon engines fitted to the Hawker Hunter, the D.H.110, the Vickers Valiant, the Supermarine Swift and the English Electric Canberra (with the "Re-heat" Avon); the Armstrong Siddeley Sapphire engines fitted to the Gloster Javelin and the English Electric Canberra, were ALL lubricated with Esso Aviation Turbo Oil 35.

in supersonic flight, once again—

It pays to say

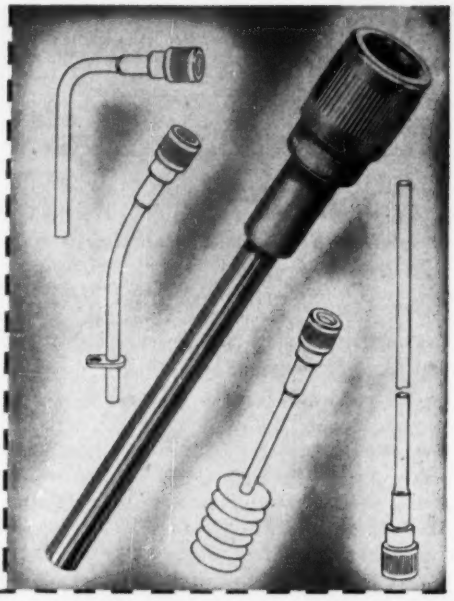
ESSO

FOR ALL PETROLEUM PRODUCTS

ESSO PETROLEUM COMPANY, LIMITED, 36 QUEEN ANNE'S GATE, LONDON, S.W.1

Weston Resistance Bulbs

The Model S.110 Platinum Resistance Bulb, used in conjunction with a Weston circular scale indicator is greatly superior in every respect to other methods of temperature measurement. Its platinum element is the most stable, accurate and the smallest yet produced for practical applications. Due to the very small size of the resistance element, the response time is extremely rapid. Reliability and long life are ensured by the fact that the element is hermetically sealed into a ¼" o/dia. stainless steel sheath which is fitted with a watertight plug connection. The socket is moulded integrally with special cable which is supplied. The Model S.110 is suitable for temperatures between −200°C. and +500°C. Full details of Weston equipment for aircraft will gladly be supplied on request.



WESTON
AIRCRAFT INSTRUMENTS

SANGAMO WESTON LIMITED
ENFIELD MIDDLESEX
Tel: Enfield 3434 (6 lines) 1242 (4 lines) Grams: Sunwest, Enfield

Scottish Factory: Port Glasgow, Renfrewshire

Branches: Glasgow, Manchester, Newcastle-on-Tyne, Leeds, Liverpool, Wolverhampton, Nottingham, Bristol, Southampton, Brighton

RESIN + GLASS FIBRE =

HIGH STRENGTH

NON-CORROSION

GOOD ELECTRICAL PROPERTIES

HIGH TEMPERATURE RESISTANCE

DIMENSIONAL STABILITY

TO GAIN THE BENEFIT OF LONG EXPERIENCE IN MOULDING AND LAMINATING

ask Ashdowns

ASHDOWNS LIMITED · Eccleston Works · St. Helens · Lancashire. Telephone: St. Helens 3206. *Ashdowns Ltd. is a subsidiary of Pilkington Brothers Ltd.*

CIVIL AVIATION NEWS

COMET 3 PERFORMANCE

PAYLOADS of 20,200 lb (78 seats) or 17,450 lb (58 seats) are quoted for the Series 3 Comet in a new de Havilland statement. In the second case, the practical stage length will be 2,700 miles, allowing adequate fuel reserves for climb, descent, stand-off and diversion, all against a 50 m.p.h. head wind. At 145,000 lb, all-up weight will be 40,000 lb more than that of B.O.A.C.'s Series 1 machines and 35,000 lb greater than the present a.u.w. of the Series 1A. A cruising speed of "around 500 m.p.h." is forecast for the Series 3 machine, which will operate at a slightly greater height than either the Series 1 or 2. It is officially confirmed that there will be some increase in wing and flap area to compensate for the increased weight, but de Havillands say the wing plan of the Series 3 will be essentially the same as that of its predecessors. Construction has begun of the prototype Series 3, which is due to fly in 1954.

PAKISTAN SURVEY

SURVEY work worth $2m is to be undertaken in Pakistan over the next four years by the Photographic Survey Corporation, a Canadian associate of the Hunting group of companies. The contract was placed by the Canadian Government as part of the $10m Canadian contribution for 1951 to the Colombo Plan, which provides for a capital development programme in Commonwealth countries of South-east Asia. The work involves 42,000 square miles of mapping preparatory to land-improvement and 123,000 square miles of geological mapping, thus covering almost one-half of the total area of Pakistan. Surveying, which began in November, is being carried out—initially at least—by one Lockheed Hudson and one Boeing B-17.

As the following schedule shows, the complete task will take nearly four years (ordinary surface methods, it is estimated, might have taken 20 or 30 years longer): January, 1953, geological interpretation of photography starts in Toronto, continuing until March, 1954; November, 1953, delivery of maps and mosaics begins, continuing progressively until November, 1955; at the same time, geologists begin two years' field work; March, 1954, airborne operations complete; July, 1954, final photographs delivered; November, 1955, geological field parties return home; June, 1956, all phases of contract complete.

TWICE OVER THE TOP

CAPT. PAUL JENSEN of Scandinavian Airlines System, who piloted DC-6B *Arild Viking* on its recent pioneer flight from Los Angeles to Copenhagen *via* Thule, completed on Monday the company's second ferry/proving flight by way of the Northern route. His co-pilot in *Hjalmar Viking*, another DC-6B, was Capt. Jan Christie, who is known in this country as a keen racing pilot. As on the previous flight, the aircraft carried a large crew —13, including reserves—and an equal number of industry and airline technicians.

Hjalmar Viking left Los Angeles at 1643 hr (G.M.T.) on December 5th, arriving at Edmonton 6 hr 24 min later; it took off again for Thule at 0239 hr on December 6th, landing on the 10,000ft runway there at 0953 hr. The flight was to have included a visit to the alternative airfield at Bluie West 8, but plans were changed *en route* and the DC-6B left Thule at 1213 hr for a direct crossing of Greenland and the Norwegian Sea to Oslo, where it landed 7 hr 32 min later. At 2105 hr it left for Stockholm, completing the journey at 2210 hr on December 6th—more than 6,000 miles in just over 22 hr flying time.

S.A.S. hope to inaugurate regular passenger-carrying flights between America and Scandinavia *via* the Arctic by mid-1953. Last year, it is estimated, 80,000 Californians (many of Scandinavian origin) flew to Europe; S.A.S. feel that their proposed Arctic service is therefore certain to divert a good share of this traffic. American companies have not so far announced any plans to use the Northern route. The extent of American operations to Scandinavia *via* Thule is presumably now under negotiation at a diplomatic level.

A TUDOR BAN RELAXED

IT was announced on December 4th that the Minister of Civil Aviation had "withdrawn his objection to granting passenger-carrying certificates of airworthiness to Tudor aircraft which meet the requirements of the Air Registration Board." The concession is, for the time being, subject to: (1) the number of passengers carried not exceeding 50; and (2) flights over water being routed within 250 miles of the nearest land. The Tudor, it will be remembered, has been involved in three widely publicized accidents, together involving the loss of some 150 lives. Two Tudor IVs of British South American Airways vanished without trace during long over-water flights (January, 1948, and January, 1949) and the cause of the disappearances was never explained. In March, 1950, a Tudor V crashed at Llandow, South Wales, killing 80 of the 83 occupants. None of these accidents could be attributed to any fault in the design or performance of the Tudor itself, but the Minister of Civil Aviation announced early in 1951 that no further passenger C.s of A. would be granted for this type of aircraft. This restriction, however, did not apply to two Tudor Vs and three Tudor IIs for which passenger C.s of A. had already been granted; subsequent experience with these and other (freight-carrying) Tudors has tended to confirm the reputation for safety and reliability won by Tudors on the Berlin Airlift, when they carried some of the heaviest loads.

On November 12th, the Minister announced that Tudors owned by the Government were being offered for sale at a price around £10,000. This offer applies to ten owned by M.C.A.—four Mk. Is and two Mk. IVs kept at Tarrant Rushton and four Mk. IVs at Ringway—and one Mk. II owned by the Ministry of Supply (also based at Tarrant Rushton). Four more Tudor IVs are kept at Hurn Airport, but are not airworthy and will be sold only as spares.

The Ministry has received some enquiries from private operators but none of the aircraft has yet been sold. The high cost of providing the Tudor with a large double door (possibly as much as £15,000, according to one source), to make it suitable for heavy freight work, has been described as one of the main reasons for operators' slow response to the M.C.A. offer. Withdrawal of the passenger-carrying ban seems likely to make the Tudor a more attractive proposition, despite the past misfortunes in which this basically sound machine has been involved.

ROYAL CHARTERS

AS reported last week, B.E.A. Elizabethan *Sir Francis Bacon* was chartered on November 26th to fly the Duke of Edinburgh to Malta from London Airport. There was a tail-wind throughout the journey and Capt. W. Baillie had to reduce speed to 173 kt at 19,500ft in order to maintain schedule. On the descent to Luqa the Elizabethan was joined by 12 R.A.F. Vampires. The aircraft flew back to L.A.P. on November 27th, returning to Malta on December 1st for the Duke's homeward journey the following day.

On the return flight the Elizabethan landed at Rome, where it was boarded by the Duchess of Kent. The Rome-London leg was flown at 235 kt at 18,500ft. As on the outward flight, the landing was exactly on schedule. The aircraft was met at London Airport by the Queen, accompanied by the Queen Mother, the Duchess of Gloucester, Princess Alexandra and Prince Michael; also in attendance were Sir John d'Albiac, the Airport Commandant; Lord Douglas of Kirtleside, chairman of B.E.A.; and Mr. Peter Masefield, chief executive of B.E.A. The Queen took the opportunity of inspecting an Elizabethan for the first time when she entered the aircraft to greet Prince Philip and the Duchess of Kent.

C.A.A. CUTS COSTS

RHODESIAN local authorities have made a joint protest against Central African Airways' decision to withdraw feeder-line Beaver services as a means of cutting losses during the current financial year. The subsidy authorized by the Governments of Northern and Southern Rhodesia and Nyasaland is £120,000; during the first six months, however, C.A.A. lost an estimated £85,000, due partly to the fuel strike and partly to the necessity to ground certain of their Vikings for replacement of spar booms. Temporary withdrawal of the Beaver services was thought to be the only way of reducing operating losses during the second half of the year. Although the average load factor of 72 per cent on the Beaver service between Umtali and Salisbury is the best attained on any of the airline's routes, the annual loss on this service alone is estimated as £2,500-£3,000.

C.A.A. are also attempting to increase revenue during the last four months of their financial year (December 1st—March 31st) by increasing fares on all internal services by 5 per cent.

INDIAN TOURIST SERVICES

USING a 56-seat DC-4, Air-India International, Ltd., introduced cut-fare services between Bombay and Nairobi on Sunday, December 7th. Operated *via* Karachi, Sharjah (a refuelling stop without traffic rights) and Aden, the services will be additional to the company's weekly first-class Constellation services; they are the first international tourist services to be operated by any Indian airline. Free surface-transport and meals will be provided and the single and return fares of, respectively, £66 and £132 will offer savings of £25 and £32, by comparison with first-class fares. The next two services are due to leave

CIVIL AVIATION . . .

Bombay on December 13th and January 4th, leaving Nairobi on December 16th and January 7th; thereafter flights will be on a fortnightly basis, leaving Bombay on alternate Sundays and Nairobi on alternate Wednesdays.

As reported in the preceding issue, tourist services will not be generally introduced in this region until October 1st, 1953; the Indian company has been able to anticipate the I.A.T.A. decision because it operates this route exclusively.

PROCTOR ACCIDENT REPORT

AN engine cut during final approach caused Proctor G-AJMX to crash about half a mile from Rochester Airport, Kent, on July 13th, 1952. The official M.C.A. report on the accident, published last week, attributed the engine cut to the failure of the pilot to open up the engine at intervals during a long descent.

Owned by Short Brothers and Harland, Ltd., the Proctor was being flown by Mr. F. W. A. Marvell on an Army co-operation exercise at a height of 10,000ft over the Southend-on-Sea area. At that height, temperature was 4 deg C compared with a surface temperature of 19 deg C. On completion of the exercise the pilot made a powered descent towards Rochester with the throttle one-third open and in rich mixture.

Intending to continue the descent into a straight approach and landing, he selected maximum r.p.m., lowered flaps to the take-off position and switched from port to starboard fuel tank (the port gauge read four gallons and the starboard 15 to 16 gallons). At about 400ft the throttle was opened, but the engine cut out after responding momentarily and spluttering. The pilot had to attempt a steep turn between two houses in order to enter the only available open space for a crash landing. In the attempt the port wing struck a fence and the aircraft was slewed into a roadway T junction, coming to rest when half-way through a fence which bordered the open ground. The pilot was unhurt, but three school girls were injured, one seriously.

The investigators found no evidence of any pre-crash failure or malfunctioning and about three gallons and 14 gallons were recovered from the port and starboard tanks respectively; there was also petrol in the carburetters. The sparking plugs, it is stated, were found to be "oiled-up" to a degree consistent with the propeller having been windmilling. Although the aircraft's documentation was in order and the pilot held a valid commercial pilot's licence, the endorsements did not permit him to fly a Proctor for aerial work: the flight was, therefore, a contravention of the Air Navigation Order (1949).

The report contains an appendix in the form of a letter from the pilot to the Chief Inspector of Accidents, in which Mr. Marvell asserts that, despite the evidence, the engine failure was due to fuel starvation and not to the engine being allowed to cool. Mr. Marvell's flying experience at the time of the accident totalled 3,840 hr, of which 30 were in Proctors. He is the holder of an instructor's rating and had passed an instrument-rating test some two months before the accident.

AMERICAN COMPANY'S CARGO BOOM

FOR the first time in any one month an American airline operator has taken over $1m (£360,000) revenue in cargo charges alone. The company concerned is American Air Lines, and it achieved this record in October, earning more money from cargo operations during the month than it did over the whole of 1945. After an intensive survey the company decided to concentrate its efforts on the drug, electrical equipment and clothing industries. Mr. C. R. Smith, president of American Air Lines, predicts that within a few years air cargo will account for as much as one third of the airlines' gross takings.

CHARTER NOTES

DURING the seven days ended December 7th, aircraft of British independent airline companies flew 67,800 miles on charter flights—12,200 miles with passengers and 55,600 with cargo. Of the total, some 42,000 miles were flown on the Berlin air ferries. Altogether, 710 tons of cargo were uplifted in 116 flights and nearly 1,300 passengers were carried in 26 flights. Only 30 tons of cargo and about 150 passengers were carried on trips not emanating from Berlin. The overall volume of traffic represented about 130,000 freight ton-miles and 246,000 passenger-miles (21,000 more ton-miles). The majority of charter work was completed by Bristol 170s, which flew 26,500 miles; Yorks flew 22,500 miles, Dakotas 18,200 miles, and Vikings about 600 miles. These operations accounted for approximately 435 flying hours and netted an estimated revenue of £34,500.

The longest flight of the week was completed by a Dakota of the Air Survey Company, which flew an urgently needed ship's propeller to Diego Suarez in Madagascar. On the Berlin Air Ferries to Hamburg and Hanover, Air Charter completed 23 passenger flights and 47 freight trips, uplifting 376 tons of cargo and about 1,150 passengers. Silver City's Bristols made 60 trips out of Berlin, carrying a total of 300 tons of bulky cargo. The company also flew 20 tons of Gervais cheese across the Channel to Lympne; they continued operations of an undisclosed nature in Africa and flew 3,500 kilos of electrical equipment from Paris to Lisbon. Eagle Aviation flew seven tons of newspapers from Manchester to Dublin in Viking aircraft and also brought 21 passengers back from Hamburg in a Dakota. Two of Eagle's Dakotas were used to bring 50 passengers from Zurich to Birmingham.

FOCUS ON APPROACH LIGHTING

AS a direct result of the approach-and-landing discussions between pilots and technicians at last May's I.A.T.A. technical conference, held in Copenhagen, Runway 10R at London Airport is to be fitted with an experimental set of sodium lights designed to assist bad-weather landings. Sets of four lights are being placed at 500ft intervals for 2,000ft of the runway; they are outside, and at right angles to, the main rows of lights, thus extending the cross-bar effect of the Calvert approach lighting. When the high-intensity system is not in use, the sodium lights, which are 2ft high, will be marked by red obstruction lamps. The I.A.T.A. Flight Technical Group, when making the original recommendation, had in mind the need to integrate "in balance, intensity and layout" runway lighting and approach lighting.

Construction of approach-light systems has been delayed at many airports, pending I.C.A.O.'s decision on the standard type of layout to be adopted. The British Calvert system was finally chosen at the end of November by delegates to the fifth session of the Aerodromes, Air Routes and Ground Aids Division, which took place in Montreal. The decision was described as the most important step towards the improvement of air-transport since the adoption of standards for radio-navigation landing aids.

The Division also considered, for the first time, "stopways" and "clearways" as ways of reducing the lengths required of permanent, stressed runways—and, thereby, of the cost involved—without any decrease in safety. The stopway is a lightly built extension of the runway to permit safe emergency landings in the event of engine failure *before* reaching safety speed; the clearway is an obstacle-free area upwind of the clearway, permitting safe take-off if an engine fails *after* safety speed is reached.

"CALLS AT BARRA are subject to weather and tide," warns the B.E.A. timetable. The Rapide is still the only aircraft which can serve this Hebrides island, and to do so it must land on a beach composed of crushed shingle. Subject to demand, there are return services twice weekly between Barra and Glasgow. One of B.E.A.'s fleet of Rapides is G-AGUR Lord Roberts, seen with passengers disembarking on the beach at Barra.

PIONAIRS, as B.E.A. call their modernized, 32-seat Dakotas, have replaced Islander-class Rapides on all but one of the Scottish island services formerly operated by the gallant de Havilland biplanes. This Pionair, G-AHCU Charles Ulm, is pictured at Stornoway, Hebrides, which is connected to Glasgow by four weekly Pionair services; a fifth links Stornoway and Inverness.

THE SLIPSTREAM HAZARD

FOLLOWING the recent accident to a Rapide at London Airport, caused by turbulent air in the wake of a Stratocruiser, the M.C.A. has published (in *Information Circular No.* 117/1952) the following recommendations for the guidance of pilots : (*a*) Never be hurried in taking off or landing behind another aircraft. (*b*) When approaching in a cross-wind keep to the windward of the approach path, and land on the up-wind side of the runway. (*c*) Maintain a little extra flying speed. (*d*) Take extra care during calm, cool days. (*e*) If propeller wash turbulence is encountered open the throttle(s) and attempt to climb out of it as quickly as possible.

THAT ALPHABET AGAIN

FOLLOWING representations from some member-states and the International Federation of Air Line Pilots Association, I.C.A.O. has decided to consider the revision of its new alphabet (see *Flight*, October 10th) at an early date. This information is included in *M.C.A. Information Circular* No. 121/1952, which also makes the important announcement that, as from December 15th, the use of the old alphabet is permitted for R/T. communication in the U.K. on any occasion when, in the opinion of either the pilot or the ATC officer, confusion might arise.

In order that a forceful, well-documented case for the alphabet's improvement can be presented to I.C.A.O. by this country, users of the alphabet are asked to submit suggestions for its improvement, with reasons to the M.C.A. For this reason, pilots are urged by the Ministry to continue the use of the new alphabet, so that its evaluation may be continued. Tactfully, the circular notes that "reports so far received indicate that there are certain words that give rise to confusion."

A TALK ON AIR-TRAFFIC CONTROL

A COMPREHENSIVE outline of Britain's air-traffic control system was given by Capt. V. A. M. Hunt, B.A., A.F.R.Ae.S., in his section lecture *Air Traffic Control Today and Tomorrow*, before the Royal Aeronautical Society on Thursday of last week. Introducing the lecturer, Mr. Peter Masefield referred to his continued association with air transport, both as an airline pilot and, since 1949, as Director, Navigational Services (Control and Navigation) at the M.C.A.

Capt. Hunt began by defining the scope of air-traffic control, and its relation to pilot decisions and operational control of flights. He outlined the British A.T.C. system, including the pattern of "advisory" routes, along which the traffic was heavy, though not sufficiently so for the introduction of full airways. One of the objects, he said, was the concentration of radar services along airways and these routes, within the general cover of the flight-information regions. The five different types of control was not too great a number, for a compromise was necessary between absolute freedom and total restriction. Major problems in the scheme's operation included the uncertainty of accurate weather knowledge and the integration of civil and military requirements.

The lecturer then described the layout of the Air Traffic Control Centre at Uxbridge, together with its internal organization and its communication with units such as the London A.T.C. radar unit, the meteorological service, aeronautical information services, and the rescue co-ordination centre. After stressing the need for fast, reliable communications he went on to give an account of the development of radar for A.T.C. use—which made possible a significant reduction in international separation standards with safety—and to compare the developed scheme for the metropolitan control zone with a possible future multi-track control system, which assumed an accurate short-range navigational aid and the use of Gatwick as an alternative.

Capt. Hunt then played back a recording of the R/T. calls on a synthetic flight from Paris to London, and of actual calls received at Uxbridge—a novel and effective form of illustration. The problems caused by the introduction of turbine-engined transports, he continued, were not serious at present, as the aircraft involved were able to fit into the existing system fairly well. But with more turbine aircraft would come the need for the application of better radar aids; visual separation at high speeds was simply not sufficient. Helicopters, in general, would fly at low altitudes, and few A.T.C. complications were envisaged.

One of the biggest future problems would be that of increasing the available runway capacity. The concept of simultaneous landings on parallel runways at London airport was being re-examined, and the hopes for a safe increase in landing rate by this means were high. The control centre of the future would combine the A.T.C. centre and the radar unit for greater efficiency. Ground control of taxying aircraft—a big problem at large airports such as London—would be by the block system, with automatic illumination of taxiway sections in use, and "mimic" reproduction on an indicator in the control tower.

In the future design of aircraft, said the lecturer, flexible cruising-speeds, greater manoeuvrability and standard approach speeds were required, together with an accurate navigational aid and improved radar control.

In the discussion which followed the lecture, the importance of co-operation between aircraft designers and the A.T.C. authorities was the main topic; other questions concerned the extent of Service interference, completely automatic control schemes, and the most suitable navigation aid. Mr. Masefield concluded by referring to the vital work of the A.T.C. personnel, which was much appreciated by the airline operators.

BREVITIES

THE Minister of Civil Aviation has approved the extension of Silver City Airways' permit for the Southampton-Cherburg car-ferry service to allow the carriage of passengers not accompanying vehicles and of supplementary freight.

* * *

Five former Luftwaffe pilots are reported to have joined Middle East Airlines, which is based at Beirut, Lebanon, and operates a fleet of six DC-3s.

* * *

The U.K. and Ireland commercial manager of Sabena, Mr. A. Van Oppens, is taking over a new post as the company's commercial manager for the Union of South Africa and the Rhodesias. Mr. Van Oppens, who has been in this country for nearly five years, is being succeeded by Mr. Albert Watrin, who was until recently assistant to Sabena's commercial director in the airline's head office in Brussels.

* * *

The new Parliamentary Secretary to the Ministry of Civil Aviation, Mr. J. D. Profumo, has appointed Mr. W. A. Penn to be his private secretary.

A bilateral agreement was recently concluded between Sweden and South Africa, enabling S.A.S. to extend its weekly Stockholm-Nairobi services to Johannesburg. For the time being, it is reported, South African Airways will not exercise its reciprocal rights by operating to Sweden.

* * *

February is now given as the date for the final opening of Johannesburg's new Jan Smuts Airport. Reunion, a new airport at Durban, was opened a few weeks ago and a third South African civil airport—at Collondale, East London—is to become operative next March. Built at an estimated cost of £150,000, this airport will provide better facilities for S.A.A. DC-4 services to Durban.

* * *

We have been taken to task for placing Blackbushe aerodrome in Surrey whereas, in fact, the whole of its area is over the border, in Hampshire. We notice that at least one directory also gives the address of Blackbushe as Surrey. The error often arises as a result of the address being written "Blackbushe, near Camberley," which latter town is in Surrey. Strictly speaking, the address should be "Blackbushe Aerodrome, Yateley, Hants."

CIVIL AVIATION . . .

A profit, after deduction of tax, of £7,270 was announced at the recent annual meeting of Airports, Ltd. The company owns Gatwick Airport, at present requisitioned by the M.C.A., and Gravesend Airport, which is occupied by Essex Aero Ltd.

* * *

Following completion of a new 9gm north-south instrument runway at Newark Airport, New Jersey, full commercial operations have been resumed. Nearly all operations from Newark had been suspended since February after a succession of fatal accidents.

* * *

California Eastern Airways, who operate seven DC-4s on the Pacific Airlift from Oakland, Cal., to Tokyo, made a total net profit of nearly £340,000 during the six-month period ended June 30th, 1952. The company maintains about 25 per cent of all the aircraft employed on the Airlift, and also runs the Columbus, Ohio, training base for the U.S.A.F.

* * *

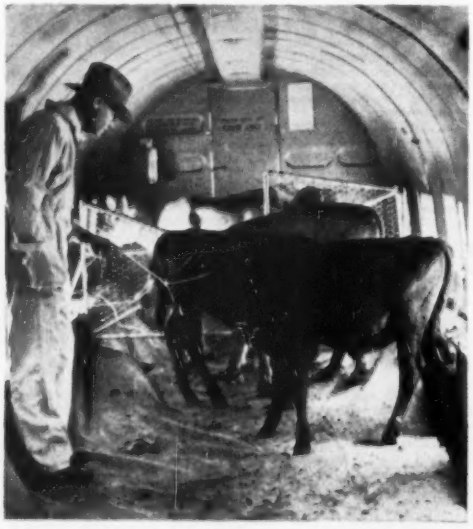
An instance of how intelligent use of air-freight services can be used to break into new markets was provided recently on the London-Amsterdam route when a London company supplied a ton of firebrick-protecting mortar to a ship about to leave Rotterdam harbour at one day's notice. The mortar was carried by a scheduled DC-3 freighter of K.L.M., who report that this cargo has not previously been flown; normally, it is claimed, an order of this kind would have been met by German suppliers.

* * *

Two unofficial records have been set up recently on scheduled services by B.O.A.C. and Swissair. The British flight, made by a Stratocruiser on November 21st, covered the 3,410 miles from London to Montreal in 12 hr 43 min—reported to be the fastest time yet achieved on the route, and representing an average speed of 270 m.p.h. Swissair claim to have set up the best time between London and Geneva with a Convair 240, which completed the 498-mile journey in 93 min—an average speed of 322 m.p.h.

* * *

On May 25th next, it is reported, the Canadian-Australasian Line's passenger-vessel *Aorangi* will be withdrawn from service between North America and Australia. The only remaining means of surface passenger travel between the two regions will then be a few small freighters with extremely limited accommodation. The growth of air travel in the Pacific is said to have made it impracticable to build, at an estimated cost of some £2m-£3m, a ship to replace the 20-year-old *Aorangi*. The opportunity thus opened to the airlines may accelerate the introduction of tourist fares in the Pacific region; present plans do not envisage an overall reduction of fares in this area before April, 1954.



LONG LIFT: Using a DC-3 freighter, Qantas Empire Airways are undertaking what is claimed to be the "largest and longest airlift of cattle ever attempted by a scheduled airline operator." Twenty calves are being carried, in two flights, from Karachi to New Guinea—a 6,000-mile journey, involving four nightstops and 17 landings en route.

EMIGRANT: As reported in "Aircraft Intelligence" (page 723), de Havilland's Beaver demonstrator, formerly registered G-ALOW, has been sold to a Southern Rhodesian company and is now based on Salisbury. Powered by a 450 h.p. Wasp Junior, the Beaver was designed in Canada for hard work under adverse operating conditions; it can fly 500 miles with a freight load of 1,250 lb or, alternatively, with six passengers.

Freight carried by B.O.A.C. (passenger) aircraft on the North Atlantic route between May 1st and October 31st totalled 550 short tons, compared with 517 tons in the corresponding period last year.

* * *

A new Air France weekly service to Tokyo from Paris was inaugurated on November 24th. The service, operated with 34-seat Constellations, takes 32½ hours flying time. There are no night stops, the only pauses being three 75-minute refuelling stops at Beirut, Karachi and Saigon.

* * *

Constellations and Stratocruisers of B.O.A.C., which are based at Filton, recently completed their first 20 million miles of transatlantic flying. Approximately 7,000 crossings have been made by the Corporation since the inauguration of regular transatlantic passenger services (with Constellations) in July, 1946.

* * *

Sabena report an unexpectedly large number of bookings from England to Brussels, Rome and Salzburg during October. The boom is explained partly by the number of business executives using air travel, but mainly by the fact that many travellers were taking advantage of reduced after-season rates offered by Continental hotels.

* * *

The claim that Convair could produce a 200-seat jet airliner by 1955—if the U.S. government would release the necessary plant and workers from military order—was made by Mr. Floyd Odlum, chairman of the company, recently. The machine, he said, would be a commercial version of the B-60 jet bomber, capable of crossing America non-stop in less than five hours and offering very low costs per seat-mile.

* * *

The establishment of a team to evaluate jet and turboprop aircraft was announced recently by Mr. C. F. Horne of the American C.A.A. The team, he said, was intended to be a central source of information on turbine powered transport developments; it would maintain contact with manufacturers, military services, experimental laboratories, foreign governments and other appropriate bodies. This would obviate unnecessary expenditure on features which might later be questioned, thereby avoiding possible delays in aircraft construction.

* * *

An increase in the carrying capacity of aircraft using U.K. airports is reflected in the October statistics for movements; although the number of movements (14,698) was only 4 per cent more than the total for October, 1951, there was a 15 per cent increase in the number of passengers (237,172) handled. The amount of freight on- and off-loaded was 3,950 short tons, an increase of 13½ per cent, but the amount of post office mail set down and picked up decreased slightly—from 1,152 to 1,143 short tons.

* * *

The U.S. Civil Aeronautics Board has asked airlines to comment on a proposed regulation requiring the installation, not later than the end of 1953, of cockpit warning lights to show when airscrews are in reverse pitch. Malfunctioning of reversible-pitch gear in a DC-6 is believed to have been a factor which contributed to the accident at Elizabeth, N.J., last February, which resulted in the loss of 33 lives and subsequent closing of Newark Airport. The crew, it is believed, not realizing that one airscrew was in reverse pitch, feathered the airscrew of another engine.

SERVICE AVIATION

Royal Air Force and Naval Aviation News

CANADIAN APPRAISAL : Seen at Filton with Bristol test pilot Walter Gibb (left) and chief test pilot Bill Pegg (right) are a group of R.C.A.F. officers who have been carrying out Britannia evaluation trials. From the left : F/L. P. McDonald, S/L. J. Drake, S/L. R. M. Beatty, S/L. J. Phillips. Recent discussions have centred on the possibility of a maritime-reconnaissance version of the Britannia being built either here or, under licence, in Canada.

Sir William Dickson Returns

AT the conclusion of his world tour, during which he had visited some 56 British, Commonwealth and American air bases in 16 countries, Air Chief Marshal Sir William F. Dickson, the C.A.S.-designate, attended a Press conference on his arrival at London Airport on December 3rd.

He spoke of the invaluable background knowledge he had obtained which would be of great assistance to him in his new appointment as Chief of the Air Staff.

Speaking of the expansion of the Australian aircraft industry, Sir William said that the Rolls-Royce Avon-engined Sabres now being produced out there would be armed with 30 mm cannon; he added that the Avon engines would give the Sabre increased power. At another factory he had seen Canberras being produced.

With the rocket range at Woomera he was immensely impressed; he thought it would furnish the means to enable us to select much earlier the weapons we should go in for in re-arming as quickly as we can.

Sir William went on to speak of the greater confidence he had seen expressed in the outcome of the operations against banditry in Malaya; he stressed particularly the importance of the employment of the helicopter in this trouble area.

Referring to what he was shown in the United States, Sir William said that America was very far advanced in guided missiles, and that the improved version of the B-36 bomber was comparable with any jet bomber.

Concluding, the C.A.S.-designate said that the re-equipment of the air forces, begun two years ago, was proceeding extremely well: "Nowhere was I depressed and nowhere did I see any slackening off."

"The programmes of the air forces are making great strides. The Australian plan, the Canadian plan, the New Zealand plan are all building up. I think we are slightly ahead of them, but they are level with us in their rate of progress. The United States Air Force is not complete yet."

Sabres on the Way

NINE Canadair-built Sabres—first main batch of the 300 for the R.A.F.—landed at Goose Bay, Labrador, last Tuesday on their way to England.

Home from Korea

LAST Wednesday, December 10th, H.M.S. *Theseus* was due to dock at Portsmouth, carrying R.N. Air Squadrons 802 (Lt. Cdr. P. H. London, D.S.C., R.N.) and 825 (Lt. Cdr. C. K. Roberts, R.N.). These two famous Sea Fury squadrons formed the flying complement of H.M.S. *Ocean* when she was in the Far East; between them they flew nearly 5,000 sorties, launched 16,000 rockets and 4,000 bombs, and shot down a Mig-15.

R.A.F. Appointments

IT is announced that the Rev. J. R. Appleyard, R.A.F., has been appointed an Honorary Chaplain to the Queen, in succession to the Rev. F. D. Morley, B.D., who has retired from the Royal Air Force. The Rev. Appleyard has been R.A.F. Principal Chaplain (United Board) since 1949.

A. Cdre. H. E. Nowell, C.B., O.B.E., who has been Assistant Commandant of the R.A.F. Staff College since 1950, will take up the newly established post of Director of NATO affairs at the Air Ministry in January. At the same time, A. Cdre. G. W. Hayes, O.B.E., until recently on the Air Board, Military Standardization Committee, will become Director of Manning at Air Ministry.

Peaked Caps Again

FROM January 1st next, all airmen of the Royal Air Force will be issued with a peaked cap (for ceremonial and walking-out purposes) as their existing headgear wears out. The wheel has thus turned full circle to the peaked cap *via* the field service, or "forage," cap and the beret. But the new cap is not identical with previous R.A.F. issues; except for the material, it resembles that issued to the U.S.A.F., with a large peak and rounded rim.

New C.O. for B.U.A.S.

IN succession to S/L. J. A. C. Aiken, who is to take a course at the Army Staff College, the new commanding officer of Birmingham University Air Squadron will be S/L. A. J. Ogilvie, D.S.O., D.F.C., A.F.C. S/L. Ogilvie completed a tour with 90 (B) Squadron in 1944 and has since been in India with No. 10 Squadron and at the Directorate of Weapons, Air Ministry.

Blind Bombing Contest

THE annual blind bombing competition for the Armament Officers' Trophy will be held on the nights of December 15th

GETTING AROUND : The picture on the left is something rather out of the ordinary. The aircraft is an American Cessna L-19A, but it bears British markings, is flown by an Army pilot—Sgt. J. Hutchins, D.F.M., of the Glider Pilot Regiment—and is carrying as passenger the First Sea Lord, Admiral Sir Rhoderick McGrigor, G.C.B., D.S.O. As might be surmised from the presence of a U.S. Army de Havilland Beaver in the background, the picture was taken in Korea, during the First Sea Lord's Far East tour. On the right he is seen boarding H.M.S. "Birmingham" from a Dragonfly.

SERVICE AVIATION . . .

to 18th. The U.S.A.F. 7th Air Division, based in Britain, has accepted an invitation to compete with the Lincoln and Washington squadrons of the R.A.F.

Each squadron will be represented by four crews, one to fly on each night of the competition. Each crew will make a simulated blind bombing attack against two inland targets, and drop practice bombs "blind" on two bombing ranges. The targets and routes will be named for crews three days before the start of the competition. Crews will be assessed on their navigation timing as well as on bombing accuracy.

Targets are to be attacked on first bombing runs, and any further runs over the targets are prohibited. Referees are to be carried in each aircraft to ensure that the stipulated navigation procedures are followed, and that no visual bombing methods are employed.

Gloucester Cup

THE Gloucester Cup has been awarded to No. 36 (Transport) Squadron, R.A.A.F., for the high standard of efficiency maintained by the unit during the past year. It was presented by Air Marshal Sir Donald Hardman and received on behalf of the squadron by the C.O., F/L. W. W. Saunders.

The Cup was given to the R.A.A.F. by H.R.H. the Duke of Gloucester and was first won, in 1947, by No. 38 (Transport) Squadron. The Duke sent the winning squadron a message of congratulation.

During the past year No. 36 Squadron had flown over 6,000 hours, carrying supplies and personnel to R.A.A.F. units in Australia and the islands.

No. 91 Wing Command

IT has been announced that W/C. D. R. Chapman, R.A.A.F., has been appointed to succeed G/C. A. G. Carr, A.F.C., R.A.A.F., in command of the Australian No. 91 (Composite) Wing in Japan and Korea. During the war W/C. Chapman served in the Middle East with No. 3 and No. 451 Squadrons.

Groves Prize and Award

THE Groves Memorial Prize for 1952 has been awarded to F/L. A. D. Dick for his paper *Range Flying and Flight Planning for Jet Aircraft*. F/L. Dick is serving at Central Flying School, Little Rissington.

Sgt. J. L. Smith has won the award for meteorological air observers for his "meritorious work and devotion to duty while serving with No. 1301 Meteorological Flight, Negombo, Ceylon."

THE AIR BATTLE

Air Marshal Sir Robert Saundby Lectures before the R.U.S.I.

INTRODUCING the lecturer at the Royal United Service Institution on Wednesday, December 3rd, the chairman, Lt-General Sir George Erskine, recalled that Air Marshal Sir Robert H. M. S. Saundby, K.B.E., C.B., M.C., D.F.C., A.F.C., was S.A.S.O. at Bomber Command H.Q. during the height of the bomber offensive against Germany and could, therefore, speak with much authority. Sir Robert's subject was *The Air Battle*.

The lecturer began by recalling how, 40 years ago, the two flying branches, the R.N.A.S. and the R.F.C., were tied almost entirely to their parent services—the Navy and Army. Slow aircraft, carrying small loads for short ranges, were useful only in aiding naval and military strategy.

In the British Services, air power as an independent force was first advocated by a small separatist group who looked upon it as a third dimension in warfare. It was brought home, the lecturer said, by the German daylight raids on London in 1916. Sir Robert here quoted the Smuts Report of 1917, which showed great foresight and was mainly responsible for the bringing into being of the Royal Air Force, in April 1918. The operative paragraph of the Report read: "Essentially the position of an air service is quite different from that of the artillery arm; to pursue our comparison, artillery could never be used in war except as a weapon in military or naval air operations. It is a weapon, an instrument ancillary to a service, but could not be an independent service itself. Air service, on the contrary, can be used as an independent means of war operations. Nobody who witnessed the attack on London on 11th July could have any doubt on that point. Unlike artillery, an air fleet can conduct extensive operations far from, and independently of, both Army and Navy. As far as can at present be foreseen there is absolutely no limit to the scale of its future independent war use. And the day may not be far off when aerial operations, with their devastation of enemy lands and destruction of industrial and populous centres on a vast scale, may become the principal operations of war, to which the older forms of military and naval operations may become secondary and subordinate. . . ."

Emphasizing this point, Sir Robert recalled the Somme battles of 1916, during which our R.F.C. squadrons were tied to their Army brigades and suffered greatly because the German air force had a measure of independence which enabled them to build up large local air pressure at critical points. It was because of this inability to concentrate the R.F.C. that an appeal had to be made to the Royal Navy for the loan of six to eight squadrons for service in France.

Despite the eventual creation of the Independent Air Force and the Royal Air Force, it was the lecturer's opinion that the 1914-18 war ended before definitely proving the use of air power. It was, he said, a two-dimensional war.

Turning then to the broad principles of warfare, Sir Robert pointed out that whereas rival armies must seek each other and fight a pitched battle, and fleets could fight or withdraw as they wished, the absence of any barriers in the medium in which they operated gave the Air Force a ubiquity of action not enjoyed by either of the older Services. Air power followed a broader aspect than the narrow aim of beating the armed forces. Today, the lecturer recalled, the fighting men were but a very small proportion of the people employed in putting them in the front line.

The Air Marshal then turned to the establishment of air superiority. He quoted the operations against Norway in 1940. This amphibious attack, he said, was a well-found invasion force but we were never allowed to build up. Local naval superiority, he thought, was an illusion where land-based aircraft were available and the outcome of the operations against Norway supported the truth of the Air Staff doctrine that the battle in the air must be won first.

Sir Robert's next point dealt with the air offensive against Germany by our Bomber Command and the 8th U.S.A.F. The Americans, he said, were determined to bomb by daylight and the R.A.F. by night. The lecturer said that there was little to choose between the two forms of attack either in the matter of accuracy or casualties. The day bombers shot down German day fighters but our night bombers carried much smaller aircrews. It was Sir Robert's opinion that Bomber Command had put the German air force on the defensive before the Americans had joined battle. He also thought that three-quarters of the German air resources were forced on the defensive until the German day fighters lost morale and the night fighters were disheartened. This battle was an example of obtaining total air superiority without picking targets in the front line.

As a final example the Air Marshal turned to the campaign in the Pacific against the Japanese who, he said, never learned the use of air power. He quoted General Kenney as saying that the Pacific islands could be retaken one by one—by soldiers with their rifles on their backs—if air superiority was first obtained.

In conclusion, the lecturer said that a successful bombing campaign can be carried out without the pre-requisite of air superiority and such a campaign may lead to the attainment of complete air superiority, but this, however, may not be so in the future now that range and speed are to be thought of in intercontinental terms. He quoted Sir Roy Fedden as having forecast greater advances during the next six years than had happened in the past six years.

Finally Sir Robert said that we must either be in position to bring about the battle for air superiority or to be ready to attack vital enemy centres without first obtaining air superiority.

In the discussion which followed, the lecturer was asked what form of air superiority was required before applying a bomber attack. To this Sir Robert Saundby replied that it was a problem which directly faced us following the Battle of Britain. Our small bomber force was outnumbered by German fighters but went ahead with a night bombing attack.

Another questioner, referring to the lecturer's comments on the Norway invasion, pointed out that not one carrier had been sunk in the last war by shore-based aircraft. *Formidable* and *Illustrious* had both been damaged, but only while they had no fighters on board. The questioner asked what method, then, would the lecturer employ to stop our ships being sunk in the Atlantic if the use of carriers was discontinued. To this the lecturer denied having said that carriers were of no use for local protection; he had implied that shore-based protection was also necessary.

The chairman, in closing the discussion, said that in his opinion the most difficult feature of air warfare was the selection of targets.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

The Elusive B.A.T.

IN his letter published in your issue of November 28th, Mr. J. M. Bruce refers to a B.A.T. Bat powered by a 100 h.p. Gnôme engine and designated the F.K.22.

Frederick Koolhoven, like all great aircraft-designers, had an extremely fertile brain and a number of designs were considered before the final one was put on paper. However, as a member of the British Aerial Transport Company at that time, I can answer Mr. Bruce's query by saying that the only military types built and flown were the Bantam, powered by an A.B.C. Wasp engine; the Basilisk (A.B.C. Dragonfly); and the Baboon, a two-seat trainer (A.B.C. Wasp). That none of these aircraft was ever ordered was not the fault of the design firm, and when Lord Waring withdrew his support from his aviation activities a virile and progressive organization, with a great future ahead of it, was lost to this country.

I might say that I am not relying on my own memory alone—I am assured by my old friend, Cyril Turner, managing director of the Irving Airchute Co., and the second pilot to fly a Bantam (he was one of the B.A.T. Co. team of pilots), that no forerunner to the Bantam was built.

Hendon, N.W.4. R. E. NICOLL.

[Thank you, Major Nicoll. Could it be that this elusive little machine was built in America? Performance figures for a B.A.T. with 100 h.p. Mono. Gnôme, appearing in *Flight* of February 13th, 1919, were from an American source.—ED.]

More about the Brisfit

IN his excellent "potted history" of the Bristol Fighter (November 7th), Mr. Bruce has succeeded in compressing a very generous amount of factual information into the space available, and obviously has plenty more in reserve. He has wisely referred to the variants of the Brisfit by their *contemporary* designations, and for this he has been taken to task by Mr. Green in the correspondence columns of your November 28th issue. Mr. Bruce knows, as I do, that Bristol type-numbers were first introduced in 1924, after Capt. Barnwell's return from Australia, and that all numbers prior to 90 are retrospective, so he is quite correct in referring to Types 96 and 96A only. Since, however, Mr. Green has given a list of the retrospective numbers that is incomplete, may I ask you to publish the following correct list:—

Type	
12	F.2A with either 190 h.p. Rolls-Royce or 150 h.p. Hispano.
14	F.2B with 190, 225 or 275 h.p. Rolls-Royce Falcon.
15	F.2B with 200 h.p. Sunbeam Arab.
16	F.2B with 200 h.p. Hispano.
17	F.2B with 300 h.p. Hispano (*not* Puma).
17A	F.2B with 300 h.p. Hispano for Belgium and Spain.
17B	F.2B with 300 h.p. Hispano for Mexico.
27	Coupé conversion with 275 h.p. Rolls-Royce Falcon.
28	3-seat tourer (closed) with 240 h.p. Siddeley Puma.
29	2-seat tourer (open) with 240 h.p. Siddeley Puma.
34	3-seat tourer seaplane with 200 h.p. Wolseley Viper (project only).
40	F.2B with 240 h.p. Siddeley Puma for Norway.
45	2-seat tourer (open) with 240 h.p. Siddeley Puma, for Scandinavia.
47	3-seat tourer (open) with 240 h.p. Siddeley Puma.
48	3-seat tourer (open) seaplane with 240 h.p. Siddeley Puma.
76	F.2B with 400 h.p. Bristol Jupiter IV.
76A	F.2B with 400 h.p. Bristol Jupiter IV with alcohol fuel supply for take-off.
76B	F.2B skiplane with 400 h.p. Bristol Jupiter IV, for arctic trials in Sweden.
81	2-seat advanced trainer version with 240 h.p. Siddeley Puma.
81A	2-seat trainer with 240 h.p. Siddeley Puma, for Greece.
86	2-seat trainer with 275 h.p. Rolls-Royce Falcon, for Greece.
86A	3-seat tourer (open) with 275 h.p. Rolls-Royce Falcon (project only).
88	2-seat tourer (open)
88A	Ditto, later version } 200 h.p. Wolseley Viper, for Bulgaria.
89	2-seat trainer with 400 h.p. Bristol Jupiter IV.
89A	2-seat trainer with 420 h.p. Bristol Jupiter VI and auto-slots.
96	F.2B Mark III.
96A	F.2B Mark IV.

Of these, Types 17A, 17B, 76, 76A, 76B, 81, 81A, 86, 88A, 89 and 89A had oleo undercarriages; Types 17A, 17B, 81A, 86, 88A, 89 and 89A had Frise ailerons; Types 17B, 81A, 86, 88A, 89A and 96A had enlarged horn-balanced rudders; and Types 34 and 86A were not built.

Concerning quantities built at Filton and Brislington, the figure of 2,602 quoted in Mr. Bruce's article is 524 short of the number built under World War I contracts up to July, 1919. The total number, including post-war R.A.F. contracts up till 1926, amounts to 3,571 built at Bristol; of these 185 were built as, or subsequently converted to, dual control by the Bristol Company.

I have already taken up too much of your valuable space, but I would like to add the two versions of the Sopwith Snail, also the Avro Avocet, to the list of British light fighters already mentioned elsewhere in your columns.

Bristol. SENRAB.

[This is evidently the definitive utterance on Brisfit type-numbers. But "Senrab" failed to read the article on light fighters with the assiduity betokened by his letter. The Avro Avocet (which was competitive with the Vickers Vireo) was mentioned.—ED.]

The Technician's Dilemma

I HAVE seen a reprint of an article published in your issue of October 10th, entitled "The Young Technician"—an account of a recent lecture given at Nottingham University by the Chairman of Rolls-Royce Ltd. Lord Hives made four basic points:—

1. That Rolls-Royce expected not so much technologists as men capable of thinking straight, possessed of initiative, and trained in the fundamental sciences.

2. That Rolls-Royce can do better than any institute of technology in the matter of training in the fields it covers.

3. That the best potential graduates read (for one reason or another) arts degrees rather than engineering.

4. That there was room for an improvement in quality.

Of course there is room for an improvement in quality; there always has been and there always will be. But the universities are still training men to think clearly (and they are now getting about four times as many good brains to work on as they did when Lord Hives was a boy). Nor is there any less initiative at the universities than formerly. There simply are not enough first-class men (interpreting "first-class" to include both brains and character).

The question why many of the best potential men are not trained in the fundamental sciences admits of a fairly simple answer. Even in those schools where money is forthcoming to build and equip the necessary laboratories, it is almost impossible to staff them—even by scientists, let alone by engineers—because the great majority of the best scientists and engineers are going into industry. It is only the exceptional few men who find their way into teaching, and those not always among the best. And so the situation persists in which the best training in schools, and the most inspired, is for the most part still given in "arts" subjects.

I would ask Lord Hives whether industry in general, and Rolls-Royce in particular, has seriously considered what can be done about this situation, apart from grumbling at it? Is industry prepared to explore the possibilities of endowing schools as it has endowed universities? Is it prepared to follow up a recent suggestion of the Vice-Chancellor of Nottingham that suitable schoolmasters should be offered opportunities of research or advisory work during their holidays? Or, at university level, is Rolls-Royce prepared to train men of ability who have read an Arts subject but who have an interest in things mechanical? The excellence of the training is not disputed, but it might with advantage be offered to a wider selection of men, as indeed it is in other industries, such as textiles, whose technology is also complicated.

I feel that Lord Hives is not entitled to complain because industry finds that, having tipped the balance heavily towards applied science and at the same time competed among itself for the services of the best scientists and engineers, it is now short of trained material. A. W. SELWYN.

Oxford. Assistant Secretary (Technical).
Oxford University Appointments Committee.

[A letter on this subject, published on November 28th, bore the signature "Forty-Six Aerodynamicists." This should have read "Forty-Six Aerodynamicists and Stressmen." One of the latter, incidentally, has written to say that, among the 46, stressmen were in the majority—ED.]

Tailplece

I WAS interested to see the correspondence about lost control surfaces. When I was an instructor in Canada during the recent war we heard of an instructor at 37 S.F.T.S., Estevan, Sask., who did a whole session of circuits and bumps with a pupil, and with only the port tailplane and elevator attached. The starboard surfaces lay on the airfield near the end of the runway, and it is alleged that this instructor and his pupil were highly amused to think that someone had lost half his tail. They were less amused when they got out of their Anson (a Canadian Mk 2) and found that the surfaces belonged to their own machine!

Birmingham, 32. J. M. BRUCE.

THE INDUSTRY

Westland's £10 m Order-book

AT the annual general meeting of Westland Aircraft, Ltd., held in London recently, Lord Aberconway (chairman) told shareholders that the company and its subsidiaries had orders on the books approximating to a value of £10 m.

Speaking of the success, in Naval service, and in Korea, Malaya and elsewhere, of the S.51 and S.55 helicopters, now in production, Lord Aberconway emphasized that the company undertook the manufacture of both types purely as private ventures, believing that the inherently sound design and proven flying capabilities of these machines would in no long time commend them to the British armed forces and to civilian users. "There are, I believe," he continued, "few if any similar cases to be found in post-war aeroplane manufacture where a private concern has entered upon an undertaking of this magnitude relying solely upon its own resources. The company's action has made available to the British Services, many months, perhaps many years, earlier than would otherwise have been possible, rotary-wing aircraft of which the military value in modern war has been abundantly demonstrated."

Of the Westland Wyvern, Lord Aberconway said that development problems had now been overcome, and that a series of these strike fighters was awaiting delivery to the Royal Navy as soon as M.o.S. clearance was received.

Normalair, Ltd., an associated company, now had its equipment incorporated in almost every British military and civil aircraft designed to fly at high altitudes. Additional manufacturing plant had been set up in the London area, and service depots in Canada and Australia.

New Ground Power Units

NEW electrical power units for use at airports and airfields have been developed by Petbow, Ltd., of Richborough Works, Sandwich, Kent. The ground power units for aircraft servicing, developed from the welding plants which are among the company's principal products, provide a range of outputs from 28 V, 200 amp to 112 V, 500 amp, and dual-voltage units are at present being developed. One outstanding feature of these units is the "Petboost" automatic control circuit, designed to boost the output momentarily to meet the starting demand of large modern gas-turbine power-plants. Although this peak demand is not continuous, it may be of the order of 100 kW in extreme cases; actual power requirement for starting the Comet, for example, is stated to be 1,000 amp at 28 V, for a few seconds, though the normal continuous load is only 400 amp. Ordinarily, the engine and generator of the power unit, to meet this momentary demand, would have to be of heavier and more costly design than that required for the normal continuous load. "Petboost" thus offers obvious economy in size and cost. For Comet starting, the Petbow plant would need only a 25 h.p. engine with a 400-amp generator.

Also in production by the company are generating sets designed to provide power in the case of mains failure. These range from an 800-Watt type powered by a small petrol engine to one of 140 kW using a six-cylinder 220 h.p. Diesel engine, and are entirely automatic in operation. The units are of simple design, and it is claimed that they use fewer components in the automatic control circuit than any other comparable plant. To overcome the short delay (approximately seven seconds) between mains failure and the full-speed running of the auxiliary plant, which might prove disastrous at an airport, the plant may be started by a remote switch at the control tower, as a precaution against such failure at a critical period. The change-over to auxiliary power would then be instantaneous in the event of mains-failure occurring.

LORD DE L'ISLE AND DUDLEY, Secretary of State for Air, recently visited the de Havilland aircraft engine, airscrew and guided-missile experimental establishments in London and Hatfield. First row (left to right): Sir Geoffrey de Havilland; A. Cdre. W. H. Kyle, Director of Operational Requirements (A); the Minister; Mr. F. E. N. St. Barbe, D.H. Aircraft Co. deputy managing director. Second row: Maj. F. B. Halford, chairman, Engine Co.; Mr. W. E. Nixon, managing director, Aircraft Co.; Sir Ralph Sorley, managing director, Propeller Co.. Third row: Mr. C. James; Mr. R. E. Bishop, director and chief designer, Aircraft Co.; S/L. G. L. Pendred, P.A.S. to the Minister; Mr. A. F. Burke, managing director, Engine Co.

Rubery Owen Prize-Giving

TWO member-companies of the Rubery Owen organization, Electro-Hydraulics, Ltd., and Rubery Owen (Warrington), Ltd., together held their annual apprentice prize presentation on November 25th. Among those present were Mr. C. W. Sharp, managing director, Electro-Hydraulics; Mr. Tattersfield and Mr. Neilson, Electro-Hydraulics; Mr. Holmes, Conveyancer Fork Trucks, Ltd.; Mr. Edwardes, Rubery Owen (Warrington) Ltd.; and Mr. Phillipson, chief education officer for Warrington, who presented the prizes.

After a period of silence in memory of Stanley Morris, an apprentice who had been killed in the Farnborough Display accident, the chairman, Mr. Sharp, made the opening speech. He stated that the companies' directors were presenting a shield, to be known as the Stanley Morris Memorial Prize, to be awarded annually to the apprentice, from each company, attaining the best all-round performance. Speaking of the engineering industry, the chairman then mentioned the shortage of technical staff, modern technical developments, and the necessity for first-class training, and related these facts to the opportunities within the organization.

Mr. G. F. Archer (apprentice supervisor) reported favourably on the standard of the apprentices' work, and described the new training syllabus at their workshop and school. Technical examination successes included those of two apprentices who had been awarded Lancashire County Technological Scholarships, and of five who obtained 100 per cent in mathematics.

Prizes were presented by Mr. Phillipson, who emphasized that the fullest advantage should be taken by apprentices of the available opportunities, as the country was most dependent on the efforts of the engineer. On Mr. Sharp's suggestion, Mr. Morris, father of the late Stanley Morris, then presented the technical reference-books which accompany the Memorial Prize to R. A. Phillips (Electro-Hydraulics) and G. Jackson (Rubery Owen), the best all-round apprentices. To conclude, refreshments were served, and the apprentices staged a cabaret entertainment.

IN BRIEF

THE Plessey Co., Ltd., report a trading profit of £844,978, or £234,190 after charging taxation. A final Ordinary share dividend of 12½ per cent will bring the distribution for the year to 25 per cent.

* * *

The directors of Desoutter Brothers (Holdings), Ltd., have declared a dividend of 2½ per cent gross on the 5½ per cent cumulative preference shares of £1 each for the half-year ending December 31st, 1952.

* * *

Believed to be the largest private automatic telephone exchange in the world, the new 1,700-line installation manufactured by the General Electric Co., Ltd., and installed by the Reliance Telephone Co., Ltd., has recently been put into operation for the Bristol Aeroplane Co. Ltd., at their Filton works.

* * *

At the recent annual general meeting of Cornercroft, Ltd., Mr. J. Alan Corner (chairman and managing director) said that the company's engineering (jig, tool and specialized equipment) and aircraft sections were contributing materially to the rearmament programme. Consolidated trading profit was £132,093, but taxation provision would take £82,247.

* * *

Capt. "Jerry" Shaw, who has now retired from the Shell organization at the age of 60, after 31 years' service, estimates that as well as visiting every European country except Russia he has travelled to no fewer than 62 other countries and territories, frequently on survey and proving flights over new routes. We published a detailed appreciation of his career in our issue of November 21st.

THE

Bristol

AEROPLANE COMPANY LIMITED

have the following

VACANCIES

FOR

TECHNICAL ASSISTANTS

in the

Aircraft Design Technical Office—

A A Senior Technical Assistant for **WEIGHT ESTIMATING AND WEIGHT CONTROL AT FILTON.**

B An Intermediate Technical Assistant for **WEIGHT ESTIMATING AND WEIGHT CONTROL IN THE LONDON DESIGN OFFICE.**

Qualifications required are some experience in similar work, particularly for the senior post, and a Higher National Certificate or equivalent academic standard in aeronautical or mechanical engineering.

C Intermediate Technical Assistants for **STRUCTURAL DESIGN** analysis at Filton.

First-class academic qualifications are required, preferably an Honours Degree in Engineering, or the Diploma of the College of Aeronautics. Some experience in an aircraft design office on similar work is preferred.

★

The Company has a wide range of designs in progress, including large civil aircraft, helicopters and advanced new military projects. Salaries, working conditions and prospects of promotion on merit are excellent.

Facilities for subsidized private flying are provided at Filton.

Applications should be addressed to the Personnel Manager, Bristol Aeroplane Company Limited, Aircraft Division, Filton House, Bristol.

the material for..

JIGS • FORMERS • MOULDS

RUBBER PRESS TOOLS • ETC

Between metal and wood comes JICWOOD 'C', a material lighter than Aluminium Alloy yet stronger than any hardwood. Hardness and immense durability are others in a list of virtues that give a very wide range of industrial usefulness to this valuable result of Airscrew-Jicwood specialisation in wood technology.

JICWOOD 'C' was first developed when no other suitable material could be found able to withstand the high stresses affecting the roots of propeller blades fitted to military aircraft. In this role it has proved its fitness every time—an indication of its actual strength.

For fuller information write to

THE AIRSCREW COMPANY & JICWOOD LTD

WEYBRIDGE · SURREY

Telephone: Weybridge 1600 · Telegrams: Airscrew, Weybridge

AVIATION TRADERS LIMITED

Our A.R.B. Approved Bonded Stores at Southend, Stansted and Blackbushe Airports, carry among the largest stocks of Airframe, Engine and ancillary spare parts in this country. We offer the following selection of spare parts:—

SECTION 5/ REFERENCE NUMBERS

5A/2334	Lamp, Aldis Signalling
5A/3035	Switches, Rotary, type H
5C/430	Terminal Block, type B, 2-way
5C/432	Terminal Block, type B, 3-way
5C/723	Switch, Magnetic Relay
5C/1079	Lamps, Terry Anglepoise
5D/938	Switches, thermostatic
5E/1349	Cable, "Dumet 19"
5E/2218	Cable, Uniradio 18"
5E/2403	Cable, "Unirubber 2.5"
5U/363	Control Panel, type 5
5X/194	Plug, 2-pin

SECTION 10/ REFERENCE NUMBERS

10H/431	Socket, 2-pin
10H/434	Plug, type 210
10H/435	Socket, type 176
10H/438	Plug, type 438
10H/451	Plug, type 217
10K/18	Power Unit, type 33
10K/293	Power Unit, type 173
10K/1258	Rotary Transformers, type 79
10K/1470	Power Unit, type 33B
10K/13066	Power Unit, type 35A
10K/13023	Control Unit, type 203

MISCELLANEOUS

1E-AR-280-BHC	Feathering Pump, c/w motor
106A/162	Pitot Head
37A/1803	Booster Coils

We shall be pleased to receive your inquiries for any of the above-mentioned items, or items which do not appear above, but are included in R.A.F. Sections 5, 6, and 10, AGS items, and components, engine and airframe spares.

ALL INQUIRIES TO OUR SALES DEPARTMENT AT:—

15 Great Cumberland Place London W.1

Telephone: AMBassador 2091 (5 lines). *Telegrams:* "Aviatrade, Wesdo, London." *Cables:* "Aviatrade, London."

THE

Bristol

AEROPLANE COMPANY LIMITED

have

VACANCIES

in their Aircraft Design Drawing Offices in Filton and London for:—

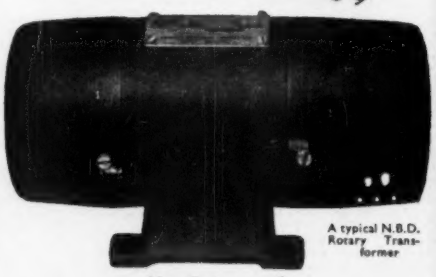
SENIOR AND INTERMEDIATE DRAUGHTSMEN

preferably with experience on aircraft or light mechanical design.

The Company has a wide range of designs in progress, including large civil aircraft, helicopters and advanced new military projects. Salaries, working conditions and prospects of promotion on merit are excellent. Facilities for subsidised private flying are provided at Filton.

Applications should be addressed to the Personnel Manager, Bristol Aeroplane Company Limited, Aircraft Division, Filton House, Bristol.

NEWTON-DERBY



A typical N.B.D. Rotary Transformer

Manufacturers of:

ROTARY TRANSFORMERS
AIRCRAFT GENERATORS
and AUTOMATIC CARBON PILE VOLTAGE REGULATORS

ELECTRICAL PLANT SPECIALISTS

NEWTON BROTHERS (DERBY) LIMITED

Service to the aircraft industry . . .

Offering a comprehensive service to the aircraft industry, Heston Aircraft have long specialized in the design and manufacture of a variety of aeronautical equipment — from simple components to complete aircraft. Typical of their precision-made work is this flush-fitting filler-cap (standard S.B.A.C. model) — produced in aluminium alloy, with extruded lever and die-cast lid and base. Suitable for all climates, it is used by all leading aircraft manufacturers.

THE HESTON AIRCRAFT COMPANY, LIMITED

Heston Airport, Hounslow, Middlesex

Halls

AIRCRAFT FINISHES

APPROVED BY A.I.D. AND A.R.B.

are supplied to

THE BRISTOL AEROPLANE COMPANY LTD

and were used on the interior of the

'BRABAZON I'

★

JOHN HALL & SONS

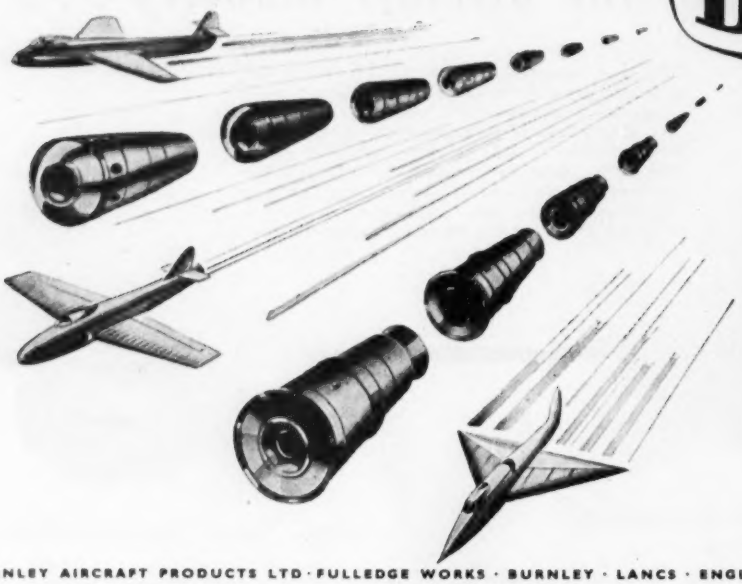
(BRISTOL & LONDON) LTD., BRISTOL

Hengrove, Bristol, 4, and 1-3 St. Pancras Way, London, N.W.1.

Precision in sheetmetal

FOR THE AIRCRAFT INDUSTRY

B·A·P



Specialists in the production of jet pipes, flame tubes, exhaust units, discharge nozzles etc. Repair programmes carried out.

BURNLEY AIRCRAFT PRODUCTS LTD · FULLEDGE WORKS · BURNLEY · LANCS · ENGLAND Phone: Burnley 3121

n.d.h. 943

THE

Bristol

AEROPLANE COMPANY LIMITED

have

VACANCIES

in their Wind Tunnel Department for

INTERMEDIATE TECHNICAL ASSISTANTS

for carrying out tests and interpreting results. Applicants should be of degree standard or hold the Higher National Certificate in aircraft engineering, preferably with previous industrial experience.

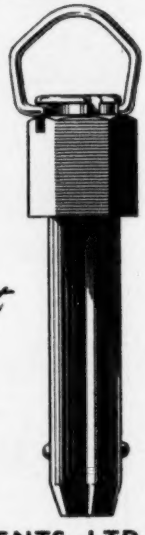
The Company has a wide range of designs in progress, including large civil aircraft, helicopters and advanced military projects. Salaries, working conditions and prospects of promotion on merit are excellent. Facilities for subsidised private flying are provided at Filton.

Applications should be addressed to the Personnel Manager, Bristol Aeroplane Company Limited, Aircraft Division, Filton House, Bristol.

PiP PiNS

POSITIVE SELF LOCKING QUICK RELEASE REGD. (Fully Patented)

FOR EVERY LOCK PIN APPLICATION WHERE QUICK RELEASE POSITIVE SELF LOCKING IS AN ADVANTAGE



✱ *Adaptability*

The range of sizes is mechanically unlimited. Wherever a locking pin is needed Pip Pins will do the job more quickly—more efficiently—and, in the long run, more economically.

✱ *Simple operation*

Only a simple axial movement is needed to engage or release—the other hand is free to support the member being erected or dismantled.

✱ *Positive Engagement*

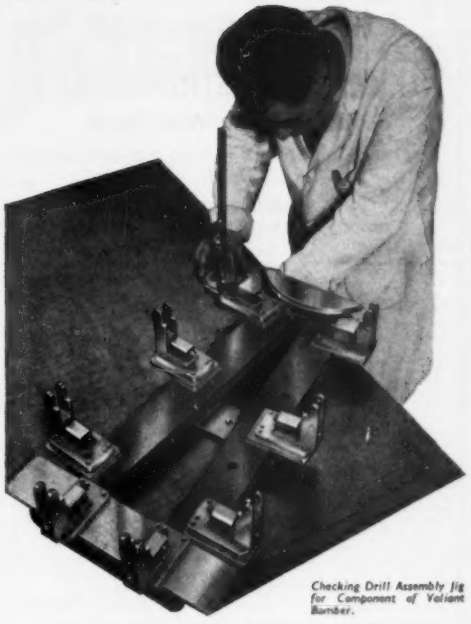
Inserting the Pip Quick Release Pin is as simple as pushing home an ordinary pin or bolt—but once the operating spindle is released the Pin is automatically and positively locked.

✱ *Self Contained*

The patented internal locking system obviates the need for any further locking device—a great boon under cold, wet conditions or in confined spaces.

AVIATION DEVELOPMENTS LTD.

Kingsbourne House, 229-231, High Holborn, London W.C.1.
Tel.: CHAncery 8601 (8 lines)



Checking Drill Assembly Jig for Component of Valiant Bomber.

OPPOSITION CHEERS . . .

Specialists in

JIGS & FIXTURES
PRESS TOOLS
GAUGES
STAMPINGS
CAPSTAN LATHE WORK
MACHINED COMPONENTS
SPECIAL MACHINE TOOLS
PLASTIC MOULDS
REPETITION WORK

Also

RATCHET SPANNERS AND A COMPLETE RANGE OF "LEYTOOL" HIGH QUALITY HAND TOOLS

. . . or rather, it stimulates. It is when we British encounter stiff opposition that we are stimulated to our greatest achievements.

THIS TIME we are making the tools that will render the fight unnecessary. YOU want the best tools . . . WE make them.

Fully A.I.D. Approved Ref. No. 7936/2/30.

Leytonstone JIG & TOOL Co. Ltd.

LEYTOOL WORKS, HIGH RD., LEYTON, LONDON, E.10
Phone Leytonstone 5022-4

Before axe or cross-cut is laid to spruce or pine . . . or the cry of "*Timber!*" presages the crash of forest giants . . . WILLIAMSON AIR SURVEY CAMERAS play their part.

For the laborious business of survey-on-foot of unmapped or uncharted forestry areas is a thing of yesterday. The unerring lens can reveal to the trained eye the height and genus of the timber, its suitability for cutting, its accessibility, etc.

In Canada, over 950,000 square miles of inadequately mapped territory have been surveyed from the air with WILLIAMSON AIR SURVEY CAMERAS AND PHOTOGRAPHIC EQUIPMENT.

WILLIAMSON

Manufacturing Company Limited

Photographic Engineers

LONDON

In Canada : Williamson Company of Canada Ltd., Toronto, Canada

W.M.I.

PERMANENT & PROGRESSIVE POSTS AVAILABLE

Important interesting work on civil and military aircraft, hydraulic accessories, air conditioning equipment, turbine units, gun control systems, also guided weapons, industrial electronic apparatus.

3 SENIOR DESIGNERS
4 INTERMEDIATE DRAUGHTSMEN
5 JUNIOR DRAUGHTSMEN

Young men free of National Service (or shortly due release) particularly invited to apply. If of good education, previous experience not essential. Special facilities for junior employees for further technical study.

6 STRESSMEN

Candidates must hold degree. Previous experience not essential, but salary adjusted for previous responsible employment in these fields.

7 MATHEMATICIAN

For stress calculating.

8 MATHEMATICIAN

First class honours or higher degree for work on guided weapon control systems. Knowledge of statistics and noise essential.

Apply in confidence with full details, quoting reference number of post sought, to:

Personnel Manager,
DE HAVILLAND PROPELLERS LTD.,
Hatfield, Herts.

THE SUPERMARINE WORKS
of
VICKERS-ARMSTRONGS LTD.
HURSLEY PARK, WINCHESTER

require design staff for work on high-performance aircraft.

DRAUGHTSMEN
Mechanical
Structural
Electrical
Full-scale Layout
Rig Testing

TECHNICAL ASSISTANTS
for
Structural Calculations
Structural Testing
Flight Test Aerodynamics
Flight Test Instrumentation
Electronics
Thermodynamics

Previous aircraft experience not essential

Pension Scheme

Excellent transport facilities

Apply, stating experience, age and salary required, to:
PERSONNEL MANAGER
HURSLEY PARK, NR. WINCHESTER, HANTS.

I.C. ENGINE DESIGNERS
URGENTLY REQUIRED

GOOD PROSPECTS FOR THE RIGHT TYPE OF APPLICANT

SALARY ACCORDING TO AGE, QUALIFICATIONS AND EXPERIENCE

APPLY IMMEDIATELY TO:
PERSONNEL MANAGER
ROLLS-ROYCE LTD.
PYM'S LANE · CREWE

Get your spares from R. A. SHORT
Who has customers in every Airport.
A large quantity of new Rapide chairs
Numerous Merlin and Packard Merlin spares
Including P.D. 16 B.1, P.D. 18 B.1 carburettors.
We offer to the envy of all our Competitors
Rotax Magnetos N14/M2 crated and packed
As from the Makers, with not even the seals cracked.
Also S.F. 14 L.U. 7 American Bosch Mags in quantity,
And Simms F 14A-1 Mags with spares of every variety.
Do not hesitate, write to us now
For our stock, like the dear old cow
Carries the virtues of quantity and quality.

R. A. SHORT, 159 Godstone Road, Whyteleafe
Telephone: UPLands 0391

FREE — A VALUABLE BOOK

which details the wide range of Engineering and Commercial Courses of modern training offered by E.M.I. Institutes—the only Postal College which is part of a world-wide Industrial Organisation.

Courses include training for:
A.F.R.Ae.S. Examination, M.C.A. Aircraft Radio Maintenance Certificate; A.R.B. Aircraft Engineers' Licences; General Training courses in Aeronautical Engineering; P.M.G. Certificate, also courses in all Branches of Engineering.

EMI Institutes
associated with
MARCONIPHONE COLUMBIA HMV

COURSES FROM £1 PER MONTH

POST NOW
Please send, without obligation the FREE book
E.M.I. Institutes, Dept. 120
43 Grove Park Rd., Chiswick, London, W.4
Name .....
Address .....
..... BLOCK

THIS FILTER pays a dividend

30,000 satisfied users of Stream-Line Filters have proved that the regular cleaning of oil improves engine performance and reduces the frequency and cost of overhauls.
In the saving of oil alone, the filter pays for itself in a few months.

STREAM-LINE FILTERS LTD
HELE-SHAW WORKS, INGATE PLACE, LONDON, S.W.8. TEL: MACAULAY 1011

FLIGHT
and
AIRCRAFT ENGINEER

PRESS DAY — *Classified advertisement "copy" should reach Head Office by* FIRST POST THURSDAY *for publication in the following week's issue subject to space being available.*

CLASSIFIED ADVERTISEMENTS

Advertisement Rates. 4/- per line, minimum 8/-, average line contains 6-7 words. Special rates for Auctions, Contracts, Patents, Legal and Official Notices, Public Announcements, Tenders 5/- per line, minimum 10/-. Each paragraph is charged separately, name and address must be counted. All advertisements must be strictly prepaid and should be addressed to FLIGHT Classified Advertisement Dept., Dorset House, Stamford Street, London, S.E.1.

Postal Orders and cheques sent in payment for advertisements should be made payable to Iliffe & Sons, Ltd., and crossed & Co.

Trade Advertisers who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

Box Numbers. For the convenience of private advertisers Box Number facilities are available at an additional charge for 2 words plus 1/- extra to defray the cost of registration and postage, which must be added to the advertisement charge. Replies should be addressed to "Box 0000, c/o Flight," Dorset House, Stamford Street, London, S.E.1.

The Publishers retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

Situations Vacant. The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service etc. if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

A. V. ROE & Co. LTD

have vacancies for

TECHNICIANS

AT WOODFORD AERODROME CHESHIRE

POWER PLANT SECTION

Technicians are wanted for work on fuel and engine installation test rigs. Previous experience essential.

WIND TUNNEL

Technical staff are required to assist in the design and operation of a Transonic Wind Tunnel.

FLIGHT TEST AERODYNAMIC SECTION

Technicians are required for Flight Aerodynamic Investigation. Previous experience essential.

FLIGHT TEST PLANNING SECTION

Technicians are required with experience of development and Contractor's trials.

Applicants for the above vacancies should have obtained Higher National Certificate or equivalent.

GOOD SALARIES & PROSPECTS

PENSION & LIFE ASSURANCE SCHEME

Apply, giving age, qualifications and experience, to:—

CHIEF DESIGNER
A. V. ROE & CO. LIMITED
GREENGATE · MIDDLETON
MANCHESTER

PRESS NOTICE

DECEMBER 26th issue will close for Press with FIRST POST, DECEMBER 17th.

AIRCRAFT FOR SALE

W. S. SHACKLETON, Ltd., 175, Piccadilly, London, W.1. Europe's largest aeroplane dealers (now 25 years at this same address) have the honour this week to offer for sale a truly outstanding aircraft, all-British and World-famous. It has an optimum gliding angle of 1 in 29 at 46 m.p.h. It makes no smell or noise and its petrol consumption is absolutely nil!

WHAT IS IT?

IT IS THE

SLINGSBY SKY

THE World's most famous sailplane and this is the actual Sky which flown by Mr. Philip Wills won for Great Britain the first place in the 1952 International Gliding Championships in Madrid. Other Sky sailplanes were placed third and fourth—in fact seven Sky were in the first fourteen! What Yorkshire builds today other countries will copy tomorrow!

£1,295 SLINGSBY SKY. The actual winner of the 1952 International Gliding Championships in Spain, 1952. Finished in high gloss blue and cream cellulose enamel and equipped with full instrument panel including Pullen Electrical Turn and Slip Indicator. Stowage provided for oxygen and radio equipment for which pipe lines and aerial are installed.

12 MONTHS Certificate Airworthiness by the makers, Slingsby Sailplanes, Ltd.

WHEN we sell the above aircraft it will make 124 distinct types of aircraft sold by us since we founded this business 25 years ago!

W. S. SHACKLETON, Ltd. have in stock many types of piston engine civil aircraft (Oh, yes! We have no jet fighters!) comprising:—

AUSTERS (3 types)
TIGER MOTH
MESSENGER
GEMINI
PROCTOR V
MOTH MINOR
PIPER CUB
RAPIDE
FAIRCHILD ARGUS
ETC.

W. S. SHACKLETON, Ltd., 175, Piccadilly, London, W.1. Telephone: Regent 2448/9. Cables: Shackhud, London. (0079)

RAPIDES RAPIDES RAPIDES

For a really first class RAPIDE buyers can select from a Fleet. Telephone immediately or call.

AEROSERVICES (LONDON) LIMITED
46, HERTFORD STREET, PARK LANE, LONDON, W.1.
Tel: GROsvenor 8383.
Cables: Aeropaul, London. (0040

FIELD AIRCRAFT SERVICES, LTD.,
offer
COMPREHENSIVE AIRCRAFT SERVICE
Please send your inquiries to:
FIELD AIRCRAFT SERVICES, LTD.,
CROYDON AIRPORT, SURREY.
Phone: CROydon 7777. Cables: FIELDAIR, Croydon. (0058

RAPIDE, most exceptional condition, low hours on engines, full radio equipment, eight seats, would make ideal executive transport.—Box 4104. (9006

£5,000 Avro 19 Series 2, 6-seater. Executive model. Full 12 months C. of A. Dual control. Metal wings and tailplane, radio T.R.1154/56, 1143A, S.B.A. Type R.K.2. With low airframe and engine hours.

WOLVERHAMPTON AVIATION, Ltd. Tel.: Fordhouses 2228. (9025)

AUSTER J4 (Arrow) in really first-class condition. Airframe and engine hours less than 200 since new. C. of A. until August, 1953. Attractively finished in red with red leather interior. Immediate delivery, £450.—Loxham's Flying Services, Ltd., Squires Gate Airport. (0060)

FLYING BOOTS

The perfect footwear for its purpose. ALL LEATHER. Highest grade quality in make and materials, lined throughout with beautifully soft, warm GENUINE LAMBSWOOL. A most attractive boot in Black only, with neat single strap top, stout leather sole and non-skid rubber heel.

£5 12. 6.

R.A.F. FLYING GAUNTLETS. Complete with white silk under-gloves. **42/6**

GOSPORT TUBES, specially designed replacement of 6F/154 (suitable for R.A.F. patt. Flying Helmets). **24/3**

Terms to Flying Clubs. Trade Supplied.
Send 3d. in stamps for illustrated catalogue.

D. LEWIS LTD. (Dept. F)
Leather Clothing Manufacturers for Home or Export
124 GT. PORTLAND ST., LONDON, W.1
Tel.: Museum 4314. Grams: Aviskit, Wesdo, London

AIRCRAFT & MECHANICAL DETAIL DRAUGHTSMEN REQUIRED

for a wide range of interesting, high priority, experimental and development work. Excellent opportunities for young keen men who have completed their apprenticeship to obtain design experience.

Salary A.E.S.D. rates and upwards

Please write giving age and experience to:

Chief Draughtsman
M.L. AVIATION CO., LTD.
WHITE WALTHAM AERODROME
MAIDENHEAD, BERKS.

AIRCRAFT FOR SALE

R. K. DUNDAS Limited.

DAKOTAS. Dakotas. Dakotas.

AS we have been established for many years in the air business, operators of the above aircraft write to us from time to time requesting us to dispose of their machines. As a very recent example some overseas clients of ours inform us that they would like to dispose of a number of C.47A freighters. You will appreciate therefore that as a result of these negotiations we are in a position to offer some very good machines converted and modified. We shall welcome your enquiries which shall have our usual prompt attention.

R. K. DUNDAS Limited, 29 Bury Street London, S.W.1.

WHI. 2949. Cables: "Dundasaero, Piccy, London."

CROYDON Airport. CRO. 7744. [0559

FAIRCHILD Argus. 1 complete aircraft and 1 suitable for breaking down for spares recovery. Your inspection and offers are invited.—Write or telephone R. A. Short, 159 Godstone Road, Whyteleafe, Surrey. Tel.: Uplands 0391. [0008

STINSON RELIANT 5-seater aircraft, full dual control, radio, navigation lights, now undergoing extensive C. of A. Finished in colours to suit purchaser. Make ideal charter aircraft. £675.—Keystone Garage Ltd., Kestrel Rd., Bournemouth. [0017

AEROCONTACTS, Ltd. leading distributors of new and used aircraft to all classes of operator. British Commonwealth Agents and concessionaires for S.N.C.A.S.O. and Piaggio, and many principal operators for the disposal of their fleets.—Aerocontacts, Ltd., Gatwick Airport, Horley, Surrey. Horley 1510, ext. 139. [0080

AIRCRAFT WANTED

OUR demand for good used aircraft of all descriptions is very great. Operators or owners wishing to dispose of aircraft, engines, or anything aeronautical, are asked to communicate at once to

R. K. DUNDAS, Ltd., 29, Bury Street, London, S.W.1.

WHI. 2949. Cables: "Dundasaero, Piccy, London."

CROYDON AIRPORT. CRO. 7744. [0558

AIRCRAFT ACCESSORIES AND ENGINES

RAPIDE spares—a large quantity kept in stock. Inquiries to Air Stores (Gatwick), Surrey. Tel.: Horley 1510, ext. 139. Night: Farnborough (Kent) 3383. [0012

FUEL Hose. 10.000" "Flyrite" No. 4, 1¼in bore, new condition.—H. H. Bradford, Ltd., Ramsey, Harwich, Essex. [0041

FOR Sale, Pobjoy "Niagra" fitted autogyro clutch and drive. Less than 10 hours since new. Full history.—Box 4102. [0003

VENDAIR, Croydon Airport, have in stock airframe spares and engine spares for most types of British light aircraft. Send all inquiries to Vendair, Room 51, Croydon Airport, Croydon 5777. [0036

AIRCRAFT and engine spares. We are holding huge stocks of key spares for the following equipment: Douglas airframe, Pratt & Whitney and Wright engines.—For further details: Australian National Airways, 5 Lower Regent Street, S.W.1. [0021

AIRCRAFT ACCESSORIES AND ENGINES WANTED

CHEAP Gipsy Queen II engines wanted, time expired or incomplete.—Details and prices to Box 4103. [0035

AIRCRAFT SERVICING

BROOKLANDS AVIATION, Ltd., Brooklands Aerodrome, Weybridge. C. of A. overhauls, modifications and conversions. Tel.: Bydeet 638. [0300

CRACK detection by Magna Flux. A.R.B. Certificate of Compliance coverage for aircraft parts. Prompt services; reasonable charges.

C. AND G. AIRCRAFT, Blackbushe Airport, Camberley (1600 Extn. 307). [0010

REPAIRS and C. of A. overhaul for all types of aircraft. Brooklands Aviation Ltd., Civil Repair Service, Sywell Aerodrome, Northampton. Tel.: Moulton 3218. [0307

CARAVANS

A CARAVAN "CERT"!

THE certainty of U.K.'s largest selection, of a good site through Caravan Residents' Association, of the unconditional free-van for-a-faulty-one guarantee, of free rail fares if van bought, £25 deposit lent, better h.p. terms. All branches open seven days a week. So why not send for free brochures and advice articles to Dept. F., Taplow please. A. S. Jenkinson, Ltd., equal selection London branch, 60, Oxford Street, London, W.1. Tel.: Langham 3656-7. Two minutes Tottenham Court Road Tube. Also Bath Road, Taplow, Bucks. Tel.: Maidenhead 3434-5-6. Right on main A4. Taplow station 4 mins. 37-38, Hammersmith Bridge Road, W.6. Tel.: Riverside 3141. 1 minute Hammersmith Broadway. [0569

NEW "Statesman" £1,065. Other Berkeleys from £399.10/-. New Glider 4-berth de luxe, £259.10/-, and 3-berth, £212. Safari, £66. Towing Hire purchase.—Mantles Garages, Ltd., Biggleswade. Tel. 2113. [0067

CLOTHING

R.A.F. and R.N. officers' uniforms purchased; large selection of R.A.F. officers' kits for sale, new and reconditioned.—Fisher's Service Outfitters, 85-88, Wellington St., Woolwich. Tel.: Woolwich 1056. [0647

CLUBS

REDHILL FLYING CLUB.

LEARN to fly at Redhill Aerodrome, Surrey, South London's nearest flying centre. 23 miles from Hyde Park Corner. £3/10/- per hour dual, from £2/10/- solo. Instrument flying, instructors' and advanced courses. Attractive clubhouse with full catering facilities.—Tel.: Nutfield Ridge 2240. [0347

HERTS and ESSEX AERO CLUB, Broxbourne Aerodrome, Nazeing, Essex. M.C.A. approved 30-hour course; solo flying from 30/- per hour; residential; trial lessons, 25/-; train from Liverpool Street, or Green Line Coach 715. Tel.: Hoddesdon 2463, 2421, 3075. [0330

and this particular beast of burden is quite happy to follow his own nose, notwithstanding the fact that, however many carrots he eats, he still cannot see his way in the dark!

The pilot has literally to have blind faith in his instruments when navigating in fog, darkness and at high altitudes, and he needs the finest instruments—manufactured by British skill to A.R.B. and A.I.D. standards.

Far-seeing operators rely on AERO-CONTACTS, whose comprehensive range of stocks can be INSTRUMENTAL in keeping their aircraft on the right path.

Send for our latest lists—a small extract from which includes:

Altimeters 6A/685, 6A/1203.

Artificial Horizons 6A/599, 6A/1519.

Airspeed Indicators 6A/1616, 6A/290, 6A/587.

Directional Gyros 6A/602, 6A/1297.

Turn and Slip Indicators 6A/675.

Rate of Climb Indicators 6A/942.

Also Gauges of all types, Thermometers, Fuel Indicators, etc., etc.

Your satisfaction is the incentive which spurs us on—and our transport department is equipped to bring your supplies by the speediest method, wherever you may be.

AEROCONTACTS Limited
GATWICK AIRPORT, HORLEY, SURREY
TELEPHONE: HORLEY 1510 CABLES: AEROCON HORLEY

CLUBS

PLYMOUTH AND DISTRICT AERO CLUB for Auster and Tiger Moth flying instruction: dual and solo at £3 per hour reducing to less than £2 per hour for solo flying on "Fly Yourself Hire" basis; flying instructors' courses and M.C.A. approved course for private pilot's licence.—Tel.: Plymouth 72753. [0041

CONSULTANTS

R. W. SUTTON (CONSULTANTS), Ltd., 7, Lansdown Place, Cheltenham. Tel. 5811. [0705

WING COMMANDER R. H. STOCKEN, F.R.Ae.S., Eagle House, 109, Jermyn St., London, S.W.1. Tel.: Whitehall 8907. [0419

CANADA-St. Britain Liaison service. Technical and Sales. Personal contact.—W. P. Dunphy, Consulting Air Engineer, Montreal Airport, Montreal, Canada. [0340A

PACKING AND SHIPPING

R. AND J. PARKS, Ltd., 143-9, Fenchurch St., E.C. Tel.: Mansion House 3083. Official packers and shippers to the aircraft industry. [0012

TIME RECORDERS

STAFF item checking and job-costing time recorders (all makes) for quick cash sale; exceptional condition.—Box 7241. [0040

HANGARS

STANDARD STEEL HANGARS

HANGAR (all steel) 131ft overall span x 150ft to 250ft long, clear opening 119ft 6in wide x 27ft 6in high. Doors both ends (gable end optional). Covered asbestos or steel sheets. Glazing in sides.

HANGAR (all steel) 212ft 6in overall span x 150ft to 250ft long, clear opening 200ft wide x 40ft high. Doors both ends (gable end optional). Covered asbestos or steel sheets. Glazing in roof and sides. 30ft span annexes on one or both sides if required.

ROMNEY HUTS. Suitable for airfield stores or offices. Curved buildings 25ft span, covered corrugated steel sheets. Ends as required; ex-stock.

BELLMAN HANGARS, LTD.,
TERMINAL HOUSE,
GROSVENOR GARDENS,
LONDON, S.W.1.
Grams: Unitstruct, Sowest, London. [0080

PATENTS

NOTICE is hereby given that Electro-Hydraulics Ltd. seek leave to amend the complete specification of the application for letters Patent No. 635685 for an invention entitled "Improvements relating to Aircraft Landing Gear."

PARTICULARS of the proposed amendments were set forth in the Official Journal (Patents) No. 3330, dated December 10, 1952.

ANY person may give notice of opposition to the amendment by leaving Patents Form No. 36 at the Patent Office, 25, Southampton Buildings, London, W.C.2., on or before January 10th, 1953. [0022

PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM Hunting Air Transport Ltd., of 35, Pall Mall, London, S.W.1.—

Application No. 115 (Revised) for an All Freight service initially with D.C.4, and later D.C.6A and/or Super Constellation aircraft for the carriage of freight between London and New York (Idlewild), with optional traffic stops at Manchester (Ringway) and Glasgow (Prestwick), at a frequency of from two to seven services weekly, during the period from June 1st, 1953 to May 31st, 1963.

Application No. 116 (Revised) for an All Freight service initially with D.C.4, and later D.C.6A and/or Super Constellation aircraft for the carriage of freight between London and Montreal (Dorval), with optional traffic stops at Manchester (Ringway) and Glasgow (Prestwick), at a frequency of from two to seven services weekly, during the period from June 1st, 1953 to May 31st, 1963.

APPLICATION No. 122 from East Anglian Flying Services Ltd., of Southend Airport, Southend-on-Sea, Essex, for a Normal Scheduled service initially with D.H.89a aircraft for the carriage of passengers, supplementary freight and mail between Brighton (Shoreham) and Le Havre (Octeville) at a frequency of from one to four services daily, during the period from April 1st, 1953 to March 31st, 1960.

FROM Morton Air Services Ltd., of Croydon Airport, Croydon, Surrey:—

Application No. 123 for a Normal Scheduled seasonal service, initially with D.H.89, D.H. Dove and Airspeed Consul aircraft and later, possibly with D.H. Heron aircraft, for the carriage of passengers, supplementary freight and mail between London (Croydon) and Le Touquet, at a frequency of from one to 50 services weekly, during the period from April 1st, 1953 to October 30th, 1959.

Application No. 124 for a Normal Scheduled seasonal service, initially with D.H.89, D.H. Dove and Airspeed Consul aircraft and later, possibly with D.H. Heron aircraft, for the carriage of passengers, supplementary freight and mail between London (Croydon) and Deauville, at a frequency of from one to 40 services weekly, during the period from April 1st, 1953 to September 30th, 1959.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9, Buckingham Gate, London, S.W.1 from whom further details of the application may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, must reach them within the period allowed for the making of representations or objections.

THE Council also gives notice that Application No. 71 from Eagle Aviation Ltd., of 28, Clarges Street, London, W.1, for a Colonial Coach service between London and Salisbury initially with York and Dakota aircraft which was advertised in "The Times," "The Aeroplane" and "Flight" on October 24, 1952, has now been withdrawn. [0014

PUBLIC ANNOUNCEMENTS

THE UNIVERSITY OF SOUTHAMPTON

THE SPITFIRE MITCHELL MEMORIAL SCHOLARSHIPS IN AERONAUTICAL ENGINEERING

OPEN INDUSTRIAL SCHOLARSHIPS IN ENGINEERING

APPLICATIONS are invited from candidates with industrial experience for Scholarships tenable for three years in the Faculty of Engineering, commencing its session 1953-54. These will be awarded on the results of a competitive examination to be held in May, 1953.—Further particulars may be obtained from the Academic Registrar by whom applications must be received not later than Tuesday, March 31, 1953. [0097

TUITION

A CAREER IN CIVIL AVIATION

Complete training facilities to M.C.A. application of I.C.A.O. standards, for all professional pilot/navigator qualifications on the FULL-TIME (personal coaching basis) or "STUDY-AS-YOU-WORK" (lessons, questions, model answers) method. Ideal those in Services or seeking higher licences:

COMMERCIAL, INSTRUMENT RATING,
RADIO TELEPHONY, SENIOR COMMERCIAL,
A.I.T.P. (ALSO CONVERSION), FLIGHT NAVIGATOR,
A.R.B.-TYPE RATINGS (GENERAL AND SPECIFIC).

All simulated procedures with briefing for instrument flight test.

Flying instruction at best rates.
Assistance in securing employment.
Write for advice, without obligation.

LONDON SCHOOL OF AIR NAVIGATION (1949), Ltd., 30, Orlando Square, Knightsbridge, London, S.W.7. Tel.: KENsington 8221. [0277

"AVIGATION OF EALING"

HAVE you got your Civil Pilot's Licence? NOW is the time to study, either by personal postal means or by attending at our lecture premises. Vacancies for direct tuition very limited owing to heavy bookings. Apply immediately.

WE do not have to live on an old reputation as we are building a new one day by day. Our students' successes and our methods have proved themselves the foremost in the country.

OBTAIN free details and prospectus from "AVIGATION LTD.," 30, Central Chambers, EALING, W.5 (opposite Ealing Broadway Underground Station). Tel.: Ealing 6949. [0248

TWIN CONVERSION

INSTRUCTORS' COURSES
RAPIDE OR GEMINI AIRCRAFT AVAILABLE.

APPLY, Wolverhampton Aero Club, Municipal Airport, Wolverhampton.
PHONE: Fordhouses 2236. [0000

AIR SERVICE TRAINING OF HAMBLE provides training in all branches of aviation in their flying, navigation, radio and engineering schools.

DETAILS of the numerous "ab-initio" and conversion courses available will be forwarded on application to the Commandant, Air Service Training, Ltd., Hamble, Southampton. [0970

LEARN to fly for £24; instructors' licences and instrument flying for £1 an hour; night flying £2/10/- an hour; residence 5 gns. weekly. Approved M.C.A. private pilot's licence course.—Wiltshire School of Flying, Ltd., Thruxton Aerodrome, Andover, Hants. [0253

A.F.R.Ae.S., A.R.B.Certs., A.M.I.Mech.E., etc., on "no pass no fee" terms; over 95% successes. For details of exams and courses in all branches of aeronautical work, navigation, mechanical eng., etc., write for 144-page handbook free. B.I.E.T. (Dept. 702), 17, Stratford Place, London, W.1. [0707

AERONAUTICAL, automobile or agricultural engineering. Practical full-day workshop training with graded technical courses for students with or without G.C.E. Short pre-call up or refresher courses. Syllabus from Engineer in Charge, College of Aeronautical Engineering, Sydney Street, Chelsea. Flaxman 0021. [0019

COMMERCIAL pilots' licences, technical "General" and A type-rating, conversions, personal instruction. Five-day full-time course for specific type. Special arrangements for urgent requirements. Syllabus from Pilot, College of Aeronautical Engineering, Sydney Street, Chelsea. Flaxman 0021. [0020

FREE! Brochure giving details of courses to all branches aero. eng., covering A.F.R.Ae.S., A.R.B.Certs., M.C.A. exams., etc. We are the only postal training college operated by an industrial organization. Write to E.M.I. Institutes, Postal Division, Dept. F26, 43, Grove Park Road, London, W.4. (Associated with H.V.P.) [0026

SOUTHEND-ON-SEA MUNICIPAL FLYING SCHOOL, Essex. Tel.: Rochford 54204. Comprehensive training for private, commercial licences and instructors' endorsements. M.C.A. approved for 30-hour course. Three Moth and Auster aircraft fitted with radio. Special facilities for training in instrument ratings. Hourly rates: solo, day £3; night £4. Dual 5/- extra. Contract rate £2/10. Link trainer 10/-. No fees or subscriptions. Trial lesson, 30/-. [0052

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive; unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

CROWN AGENTS FOR THE COLONIES

ASSISTANT signals officer required by the Government of Nigeria for the Aviation Department for one tour of 18 to 24 months in the first instance. Commencing salary (including allowances) according to qualifications and experience either (a) in scale £750 rising to £1,315 a year, with the prospect of permanency or (b) in scale £807 rising to £1,453 a year, on a temporary basis with gratuity of £25 for each period of three months satisfactory service. Outfit allowance £60. Free passages for officer and wife, and assistance towards cost of children's passages, or their maintenance in the United Kingdom. Liberal leave on full salary. Candidates must be Associate Members of the Institute of British Radio Engineers, or possess City and Guilds certificates in radio communication, or technical electricity, or a satisfactory pass in the Ministry of Civil Aviation radio mechanic course.

APPLY at once by letter, stating age, full names in block letters, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting on letter M.29570. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. [0004

DOWTY EQUIPMENT LIMITED

require first class sound

PRACTICAL ENGINEERS

preferably with some experience of design, development and testing of jet engine accessories, particularly flow, acceleration and speed governing controls, burners and pumps. Exceptional prospects of advancement.

SENIOR DRAUGHTSMEN

required for development work on fuel systems. Experience on light hydraulic or pneumatic controls acceptable.

SENIOR DRAUGHTSMEN

for hydraulic and undercarriage department also required.

JIG & TOOL DRAUGHTSMEN, STRESSMEN AND TECHNICAL WRITER

Important positions with prospects.

The Company's conditions are exceptionally good; there is a realistic pension scheme and the environment is ideal.

The Company employs a Housing Officer who will render every assistance.

Write, preferably in tabulated form, to
PERSONNEL MANAGER,
DOWTY EQUIPMENT LTD.
CHELTENHAM

THE
MINISTRY OF CIVIL AVIATION
offers for sale
2 AVRO XIX AIRCRAFT as follows
G-AGZT Certificate of Airworthiness expiry date: Oct. 22nd, 1952
G-AGWE Certificate of Airworthiness expiry date: June 22nd, 1953
A quantity of interior furnishings, including seats, are available for purchase separately
For further details or for permission to view apply in writing to
THE MINISTRY OF CIVIL AVIATION
FA4, Ariel House,
Theobalds Road, London, W.C.1

SENIOR DESIGN DRAUGHTSMEN

with experience in aircraft structures required.

Special salary and opportunity for top men

Write full details in confidence to:—

THE DIRECTOR
MICROCELL LTD.
56, KINGSWAY, LONDON, W.C.2

SITUATIONS VACANT

HER MAJESTY'S COLONIAL SERVICE

APPLICATIONS are invited for the following posts:—

VACANCIES for (a) a senior signals officer (CSD.74/14/01) and (b) two signals officers (CDE.58/14/01), Aviation Department, Nigeria. Duties of (a) are to assume executive control of and to maintain the aeronautical mobile telecommunications and radio navigational aid equipment at Kano and Lagos airports; to supervise the signals staff, maintain liaison with the Posts and Telegraphs Department, and ensure the co-ordination of telecommunication procedure. Also to act as adviser to the Director of Civil Aviation on telecommunications matters. Officer appointed will be stationed at Lagos. Duties of (b) are to maintain all aeronautical mobile telecommunications and radio navigational aid equipment at Department of Civil Aviation aerodromes in Nigeria and to be responsible for ensuring that I.C.A.O. procedures and practices are observed. Officers appointed will be stationed at either Lagos or Kano. Appointment is either pensionable, on probation, in the scale of £650 to £1,200 per annum (senior signals officer will be appointed at £1,130 per annum or above) or on contract in scale £705 to £1,419 per annum (minimum for senior signals officer being £1,242 per annum), plus a substantial gratuity on satisfactory completion of contract. Free first-class passages are provided for the officer and his wife, once each way each tour. Government quarters are provided, if available, at a low rental and income tax is payable at low West African rates. Leave is granted at the rate of seven days for each month of residential service. Candidates must be A.M.I.E.E. or have taken or be exempted from sections A and B of the examination for Associate Membership provided they attain Corporate Membership within three years, or have a first- or second-class honours degree in Engineering or Physics. Previous experience with aeronautical telecommunications equipment is desirable. A knowledge of modern theory and practice of radio and electricity and its application to air navigation, with particular reference to the procedures and other requirements of the International Civil Aviation Organization is necessary.

A1[g] traffic control officer, Grade II, wanted in Gold Coast. (CSD.74/13/01.) Minimum educational qualification School Certificate. Candidates must have passed a recognised air traffic control course and have had air traffic control experience. Duties will include air traffic control watch/receiver and the maintenance of air service records, etc. Appointment is on probation to the pensionable establishment with salary, according to experience, in the scale £750 by £30 to £900 per annum plus £175 per annum expatriation allowance. Outfit allowance, £60. Income tax at low local rates. Quarters provided, when available, at rental of £90 per annum. Free first-class passages for officer and wife and up to three children under the age of 13 once each way each tour. Vacation leave at rate of six days for each completed month of resident service.

INTENDING candidates should apply in writing to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith Street, S.W.1, giving brief details of their age, qualifications and experience. They should mention this paper and quote the reference number shown against the post for which application is made. [0013

BLACKBURN AND GENERAL AIRCRAFT LTD. have an extensive and progressive programme of design and development work on

MILITARY AND CIVIL AIRCRAFT

necessitating expansion of the design organisation in the following categories:—

AERODYNAMICISTS:
Sound qualifications and experience on aircraft work essential.

STRESSMEN:
Senior and Intermediate grades with sound qualifications and aircraft experience.

TECHNICAL ASSISTANTS:
Flight Test Development Section:
Senior Grade for planning of flight test programmes, flight test observing, and analysis of test results. Good aerodynamic background and previous experience essential.
Mechanical Test Section:
(a) Senior grade with experience of aircraft structural and installational test work.
(b) Intermediate grade. Preferably with experience of aircraft test work, but applicants with a good engineering background will be considered.
Weights Control Section:
Aircraft experience desirable.

DRAUGHTSMEN:—
(a) Senior grade with aircraft experience.
(b) Intermediate grade. Preferably with aircraft experience, but applicants with light structural or mechanical experience will be considered.
(c) Electrical. Aircraft experience desirable.

DESIGN offices are at Brough and Leeds. Salaries will be commensurate with ability and experience, and every consideration will be given to ensure the widest scope for extension of experience and future prospects.

Write to
THE PERSONNEL SUPERINTENDENT,
BLACKBURN AND GENERAL AIRCRAFT, LTD.,
BROUGH, YORKS. [0007

BLACKBURN AND GENERAL AIRCRAFT LTD. have an extensive and progressive programme ahead.

We are requiring:—
One WEIGHTS CONTROL ENGINEER for work on aero engines (all types), able to estimate weights from drawings and schemes and to control weight of castings and finished machine parts.
Our Works are at Brough.

SALARY will be commensurate with ability and experience, and every consideration will be given to ensure the widest scope for extension of experience and future prospects.

Write to THE PERSONNEL SUPERINTENDENT,
BLACKBURN AND GENERAL AIRCRAFT LTD.
BROUGH, YORKS. [0008

PROJECT engineer required, to be responsible for a laboratory engaged on development of aircraft fuel contents gauges and associated equipment. Applicants should possess qualifications in electrical engineering and/or physics and have had design and laboratory experience in the application of electronic techniques to airborne equipment.—Apply, in writing, quoting Ref. BE, and giving details of qualifications and experience, to the Chief Development Engineer, Waymouth Gauges and Instruments Ltd., Station Road, Godalming. [0045

SITUATIONS VACANT

PILOTS

WEST AFRICAN AIRWAYS CORPORATION have vacancies for pilots to be appointed as junior captains and invite applications from pilots who hold a current Airline Transport Pilot's Licence. West African Airways Corporation have an expanding fleet of Marathon, Dove and Warfarer aircraft.

SALARY according to qualifications and experience within the range of £1,000 per annum and £1,900 per annum.

FREE fully furnished accommodation is provided in West Africa, but married men on initial engagement may be required to serve for a few months before being joined by their families.

FREE return passages are provided each tour for the employee, his wife and up to two children, not exceeding 16 years of age.

TOURS of duty will be from 12 to 15 months with leave on full salary at the rate of one-fifth of the period of service in West Africa.

CONDITIONS of service will include membership of a pension scheme allowing retirement at 45, subject to a minimum of 10 years' service. (Retirement five years earlier may be arranged by mutual agreement.) In the case of employees not completing 10 years' service, a gratuity arrangement exists whereby, subject to a minimum of four years' service, a payment at the rate of £100 for each full year of service will be made on termination of appointment.

A COMPREHENSIVE contributory medical scheme exists for employees and their families.

APPLICATIONS should be submitted to the local Agents of W.A.A.C., B.O.A.C., Airways House (Room 105), Great West Road, Brentford, Middlesex. [0746

RADIO OFFICERS.

WEST AFRICAN AIRWAYS CORPORATION have vacancies for radio officers. Essential qualifications include possession of current M.C.A. 1st class flight radio telegraphy operator's licence.

SALARY according to qualifications and experience within the range of £1,100 per annum to £1,300 per annum (all-in).

IN lieu of benefits from a pension scheme, radio officers receive a bonus of £37/10/- for each completed three months of service.

FREE fully furnished accommodation is provided in West Africa, but married men on initial engagement may be required to serve for a few months before being joined by their families.

FREE return passages are provided each tour for the employee, his wife and up to two children, not exceeding 16 years of age.

TOURS of duty will be from 12 to 15 months with leave on full salary at the rate of one-fifth of the period of service in West Africa.

APPLICATIONS should be submitted to the Local Agents of W.A.A.C., British Overseas Airways Corporation, Airways House (Room 105), Great West Road, Brentford, Middlesex. [0741

SILVER CITY AIRWAYS, Ltd.

VACANCY exists in fully approved workshop for "A" and/or "B" licensed radio engineer.—Applications for interview, all expenses will be paid, to Manager, Blackbushe Airport, Camberley. [0965

SILVER CITY AIRWAYS, Ltd.

APPLICATIONS are invited from experienced "A" and/or "C" licensed engineers for ground and flying duties; preferably, but not essentially, endorsed for Bristol 170, Hercules engines.—Write for interview, all expenses will be paid, to Manager, Blackbushe Airport, Camberley. [0966

HANDLEY PAGE, Ltd., have vacancies for:—

AERODYNAMICISTS of degree standard or with H.N.C. in aero subjects. Previous experience preferred.

STRESSMEN of degree standard or with H.N.C. in aero subjects. Previous experience preferred.

SENIOR design and intermediate draughtsmen, preferably with aircraft experience for Cricklewood and Radlett offices. Consideration will be given to applicants with experience in light structural or mechanical engineering. Possession of O.N.C. or H.N.C. (Mech. or Elect.), an advantage.

WEIGHT control engineers with O.N.C. (Mech.). Previous experience preferred.

TECHNICAL assistants of degree or H.N.C. (Elect.) standard for the design and development of aircraft electrical systems. Previous experience preferred.

WRITE, stating age, qualifications and details of experience, to Staff Officer, Handley Page, Ltd., Cricklewood, London, N.W.2. [0934

APPLICATIONS are invited for the following positions in the London area:

DRAUGHTSMEN required for detail drawing of experimental designs of aircraft electrical equipment. Works experience essential. The positions are superannuated and give considerable scope to men with adequate experience.—Write, giving full details in strictest confidence, to the Employment Officer, Rotax, Limited, Chandos Road, Willesden Junction, N.W.10. [0891

APPLICATIONS are invited for the following positions in the London area:

DEVELOPMENT engineers required by manufacturers of A.C. and D.C. electrical equipment for aircraft. Applicants should hold at least a Higher National Certificate or preferably an engineering degree. The positions are superannuated and give considerable scope to men with adequate experience.—Write, giving full details in strictest confidence, to the Employment Officer, Rotax Limited, Chandos Road, Willesden Junction, N.W.10. [0892

SHORT BROTHERS AND HARLAND, Ltd. invite applications for the following vacancies for wind tunnel engineers:

(1) Senior technician to be responsible for running a low-speed tunnel.

(2) Senior technician to be responsible for running a transonic tunnel which is in course of erection. Immediate duties will comprise the supervision of the erection and the design of the aerodynamic balance and other equipment required, and the initial calibration. Applicants for (1) and (2) should have an engineering degree or its equivalent and several years of wind tunnel experience, and in the case of (2) a sound knowledge of compressible flow aerodynamics. Successful applicants will be expected to act as deputy in their respective spheres to the wind tunnel superintendent.

(3) Technicians with experience in low-speed tunnels. Applicants should have engineering training and some knowledge of aerodynamics.

Attractive salaries are being offered. Details of superannuation scheme, housing accommodation available and facilities for removal will be supplied at interviews.

APPLY, giving full details of qualifications, experience and salary expected to the Personnel Manager, Short Brothers & Harland, Ltd., Belfast, N. Ireland. [0015

SITUATIONS VACANT

ASSISTANT to professor of aeronautics.

GRADUATE in aeronautics or mechanical engineering required as assistant to professor of aeronautics at the Technical University of Norway, Trondheim. Commencing salary 11,000 kr. per year (1950).—Applications with full particulars and copies of testimonials to Secretary, N.T.H., Trondheim, not later than January 10th, 1953. [0956

VACANCIES exist for experienced pilots and radio operators. Permanent staff.—Apply, Transair, Limited, Croydon Airport, Surrey. CROydon 7405. [0900

SENIOR airframe design draughtsman required for structural work on new aircraft.—Applications, in writing to Chief Designer, Auster Aircraft, Ltd., Rearsby, Leicester, or to local Labour Exchange. [0899

SKYWAYS, Ltd. are extending their York fleet and require additional navigating and second officers with appropriate M.C.A. licences.—Applications to the Personnel Manager, 6-7, Berkeley Street, London, W.1. [0240

AIRCRAFT engineer required for service in Rangoon. A. and C. licence required on D.H. Dove aircraft. Good salary and allowances. Free accommodation, messing and passage.—Box 4124. [9910

SMALL firm requires sales manager for aircraft and spares, preferably with flying experience. Certain knowledge of engineering an advantage. Excellent opportunities.—Box 4123. [9009

LICENSED radio engineer and radio mechanics at our base at Stansted Airport, Essex. Apply by letter or telephone to the Senior Radio Engineer, Aviation Traders, Ltd., Southend Airport, Essex. Tel.: Rochford 56491. [0950

SENIOR and intermediate design draughtsmen with good experience of aircraft or light structural or mechanical engineering, required for aircraft and armament project work.—Apply by letter to Portsmouth Aviation Ltd., The Airport, Portsmouth. [0978

C. & D. licensed engineer with endorsement for Pratt & Whitney engine series, is required for a contract basis appointment in Rhodesia.—Applicants, preferably single, are invited to submit full details, in confidence, to Box 4170. [9023

TECHNICAL illustrator required, aged 23 or over, with considerable practical experience.—Applications, in writing to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds., stating age, experience and salary required. [0993

AIRCRAFT or mechanical draughtsmen required, all grades. Apply, stating age, experience and salary required, to The Chief Draughtsman, Alan Muntz and Co., Ltd., Aircraft Division, Langley Aerodrome, Slough, Bucks. [0950

THE DE HAVILLAND AIRCRAFT Co., Ltd., Christchurch, Hants, require ratefixers (erection, fitting, and machining), jig and tool draughtsmen.—Please apply stating age, and experience to the Personnel Manager. [0920

GLOSTER AIRCRAFT Co., Ltd., have vacancies for aircraft design draughtsmen and electrical draughtsmen.—Write, giving full details of previous experience, and salary required, to Employment Officer, G.A.C., Ltd., Hucclecote, Glos. [0910

DEVELOPMENT EXECUTIVE
for
LONDON FIRM
of
AIRCRAFT COMPONENT
and
ANCILLARY EQUIPMENT MANUFACTURERS

Age 30 - 48 *Salary £1,200 per annum.*

APPLICATIONS are invited from Engineers, with experience in Industry or the Services and able to advise on the improvement, and increased scope of the Company's activities. Replies, which will be treated by the Managing Director in strict confidence, should give full details of previous experience, and be addressed to

BOX NO. 4169

THE
HYMATIC ENGINEERING
COMPANY LIMITED
REDDITCH, WORCS.

Applications are invited from:—

SENIOR DESIGNERS
DRAUGHTSMEN

for interesting work on air compressors, pneumatic systems and other specialised equipment.

Please write giving full particulars and salary expected.

SITUATIONS VACANT

JIG and tool draughtsmen, fully experienced, required by Percival Aircraft, Ltd., Luton Airport, Beds. Good working conditions and full welfare facilities, including staff pension scheme.—Applications to the Personnel Manager, stating age, experience, salary required. [0939

WESTLAND AIRCRAFT, Ltd., Yeovil, Somerset, require stress engineers, junior and intermediate draughtsmen and technical writer.—Applications, stating age, experience and salary required, should be addressed to the Personnel Officer. [0905

ASSISTANT buyer required by south of England firm engaged on aircraft and light engineering work, to place out sub-contract orders. Must have drive and initiative.—Write, stating age and present salary.—Box 4100. [0908

JIG and tool design draughtsman required. Cheap fast transport Bournemouth and Poole areas. Prospects accommodation later adjacent airfield.—Write full details age, experience, salary required to Personnel Manager, Flight Refuelling Ltd., Tarrant Rushton Airfield, nr. Blandford, Dorset. [0962

SENIOR weight engineer required, capable of assuming full responsibility for weight prediction and analysis on project design work. Previous experience essential. Salary, gratuity and prospects. Details of superannuation scheme, housing accommodation available and facilities for removal will be supplied at interview.

APPLY, giving full details of qualifications, experience and salary expected to the Personnel Manager, Short Brothers & Harland, Ltd., Belfast, N.I. [9016

STRESS and weights engineers with aircraft experience are required by the English Electric Co., Ltd., Aircraft Division, Warton Aerodrome, near Blackpool. Salaries commensurate with experience.—Apply, quoting reference 314D to Central Personnel Services, The English Electric Co., Ltd., 336/7, Strand, London, W.C.2. [0901

ENGINEER required for theoretical and experimental work on aircraft fuel contents gauging. Qualifications: electrical engineering or physics degree or equivalent. Experience of measurements problems advantageous. Southwest of London.—Send tabulated details of experience, quoting Ref. E9, to Box 3023. [9967

ENGINEERING management. Owing to continued expansion, an internationally known engineering company has vacancies of particular interest to ambitious men aged 25 to 30 years, wishing to train for positions of responsibility in production and management. Initial salaries will be up to £1,000 per annum.

IDEAL applicants will:—

1. Have an engineering or science degree.
2. Be members of a recognised engineering institution.
3. Have had practical engineering training or experience.

APPLICATIONS from those meeting any two of these requirements will be considered.—Please write, giving age and full details of education and experience, to Box 4101. [9000

SENIOR spares schedule clerk, capable of taking charge of compilation section, required by Percival Aircraft, Ltd., Luton Airport, Beds. Good welfare facilities, including staff pension scheme.—Applications, in writing, to Personnel Manager, stating age, experience and salary required. [0997

H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [0920

ENGLISH ELECTRIC have vacancies for aircraft draughtsmen at Warton Aerodrome, near Blackpool. Men with good aircraft drawing office experience are invited to apply for these interesting positions which carry good salaries.—Write, giving full details, quoting reference 1308, to Central Personnel Services, The English Electric Co., Ltd., 336/7 Strand, London, W.C.2. [0940

WEIGHTS engineer required to take charge of weights department, also senior assistant, for work on fixed wing and helicopter aircraft. Good welfare facilities, including staff pension scheme.—Applications, in writing, to Technical Director, Percival Aircraft, Ltd., Luton Airport, Beds., giving details of age, training, qualifications, experience and salary required. [0992

TEST laboratory assistants (male) required by Percival Aircraft, Ltd., Luton Airport, Beds. National Certificate standard and previous experience on design of test laboratory equipment desirable. Good welfare facilities including staff pension scheme.—Applications, stating qualifications, experience, age and salary required, to Personnel Manager. [0996

REQUIRED immediately by Percival Aircraft, Ltd., Luton Airport, Beds, several draughtsmen with comprehensive experience of engine installations and allied systems. Good welfare facilities, including staff pension scheme. Applications, in writing, stating age, qualifications, experience and salary required, to the Personnel Manager. [0991

WELL-KNOWN, independent aviation company has vacancy for a works manager to supervise engineering and maintenance department in United Kingdom. Aviation experience by no means essential but clearly an advantage. Organising and administrative abilities and experience essential. Commencing salary £1,000 to £1,500 per annum, according to ability.—All replies will be treated in strictest confidence.—Apply, Box 4171. [9024

APPLICATIONS are invited from senior and intermediate design draughtsmen. Experience of aeroengine design desirable, but not essential. Also checkers. —Please write, stating age and giving details of previous experience in chronological order to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [0936

INSTRUMENT mechanics required for the overhaul of aircraft instruments. Applicants should have first-class experience on aircraft instruments generally, alternatively, specialised experience on sensitive altimeters and rate of climb indicators. Good wages, canteen.—Write in first instance to the Managing Director, Wynstruments, Ltd., Staverton Aerodrome, Gloucester. [0920

JUNIOR stressman required by Flight Refuelling, Ltd. Qualifications, engineering degree or H.N.C. Should be exempt from military service. Opportunity for keen young man to take part in an interesting development programme. Good salary. Excellent working conditions. Sports club. Possibility married accommodation adjacent airfield later. Cheap fast transport Bournemouth and Poole areas.—Reply, giving details of age, qualifications, experience and salary expected to Personnel Manager, Tarrant Rushton Airfield, nr. Blandford, Dorset. [0961

STRESSING engineer required by Development Department dealing with designs of structures in steel and light alloys, would also be required to decide on and carry out testing programmes. Applicants who should be good practical men should also have an engineering degree or the Higher National Certificate. Stressing experience essential, drawing office experience an advantage. This is a first-class opportunity for the right man interested in development work.—Apply with full details to Director-ate of Training, T.I. (Group Services), Ltd., Broadwell Road, Oldbury, Birmingham. [9019

MUIR & ADIE LTD.
Croydon Airport, Surrey, England
Cables: Muirair, Croydon

EXPORTERS OF
BRITISH AND AMERICAN AIRCRAFT
SPARES AND AVIATION MATERIALS OF
EVERY DESCRIPTION

Keenest Prices *C.I.F. Quotations by return*

AIRCRAFT SPRING WASHERS

TO B.S.
SPECIFICATION
S.P.47

CROSS MFG. (1938) LTD. COMBE DOWN, BATH

COTTON BAGS
FOR SPARE PARTS, etc.
WALTER H. FELTHAM & SON, LTD.,
Imperial Works, Tower Bridge Road,
Telephone: HOP 1784 LONDON, S.E.1

WOLVERHAMPTON AVIATION LTD.
THE LEADING LIGHT AIRCRAFT ENGINEERS.
THE AIRPORT WOLVERHAMPTON
tel. FORDHOUSES 2228

SITUATIONS VACANT

APPLICATIONS are invited from design draughtsmen and stressmen, also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero-engines.—Applications should state full particulars of experience and qualifications and should be addressed to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [9803]

SKYWAYS, Ltd. wish to appoint an economic statistician for work in connection with the analysis and estimation of aircraft operating costs and allied matters. Applicants should have a university degree or equivalent. Previous experience of this kind of work would be an advantage. Salary range £500-£700 per annum.—Applicants should apply by letter only to the Personnel Manager, 6-7, Berkeley Street, London, W.1. [9011]

AIR FORCE. Naval, civil and helicopter aircraft all under design and development at Percival Aircraft, Ltd., Luton Airport, Beds. Applications are invited from senior and junior draughtsmen and stressmen, for work on this interesting programme. Good welfare facilities, including staff pension scheme.—Write, giving details of experience and salary required, to Personnel Manager. [9595

DEVELOPMENT engineers, designers, draughtsmen and modification draughtsmen, technicians, technical writers, technical illustrators, technical assistants and stressmen required for aircraft pressurising, high altitude breathing, etc.—Fully detailed applications with salary required to Personnel Officer, Normalair, Ltd., Yeovil, Somerset. Local interviews arranged where convenient. [9664

THE DE HAVILLAND AIRCRAFT CO. invites applications for a post in the Structural Test House. Applicants must have had experience of testing airframe components and reporting on same, and under supervision be capable of designing and stressing test rigs.—Apply, stating age, experience and salary required, to Chief Structural Engineer (Aircraft), The de Havilland Aircraft Co., Ltd., Hatfield Aerodrome, Herts. [9003

YOUNG project engineers required who are interested in the principles and general development of small precision hydraulic and mechanical mechanisms for gas turbine engines. Selected engineers will be expected to carry out research digest and apply the principles obtained from reading reports and technical literature and must be capable of working with the minimum of supervision. Experience of aircraft fuel systems or hydraulic engineering is desirable. Salary from £500 to £800 per annum depending on qualifications.—Reply to Box No. 881, 19-21 Corporation Street, Birmingham 2. [9034

BOOKS, ETC.

"CELESTIAL Navigation for Yachtsmen," by M. Blewitt. This little book, intended especially for beginners, should receive a very warm welcome from every yachtsman who has wanted to learn the art of navigation by the heavenly bodies, but has been deterred by its apparent complexity. In particular, it will make an immediate appeal to all who feel their mathematics are not up to standard, for neither geometry nor trigonometry play any part in the author's explanation—indeed, even those who can manage little more than addition and subtraction should master this book with ease! 92 pages. Illustrated with 26 diagrams and graphs. Price 6/- net. By post 6/3 from all booksellers, or the Publishing Dept., Dorset House, Stamford St., London, S.E.1.

A Large Engineering Company

invites applications for the undermentioned appointments, necessitated by expansion of the Company's business :—

ENGINEER—B.Sc. or equivalent—for development work in connection with rotating electrical machinery.

ENGINEER with experience of development of electro-mechanical projects from inception.

DEVELOPMENT ENGINEERS—H.N.C. standard—capable of sponsoring electrical component design from specification to production stage.

WIRING EQUIPMENT ENGINEER. Experience to cover Aircraft, Marine or Vehicular equipment.

ASSISTANT ENGINEERS. Experience covering any of the above-mentioned fields.

The appointments are of a permanent and progressive nature. Company superannuation scheme in operation. Please write, in confidence, giving details of qualifications and salary required to Box No. 4140

THE
Bristol
AEROPLANE COMPANY LIMITED
has the following

VACANCY
for a
TECHNICAL ASSISTANT
in the Aircraft Design Drawing Office:—

Technical Assistant, with engineering degree, for design and development of PRESSURISING AND AIR-CONDITIONING SYSTEMS, including thermal and acoustic insulation and heat exchangers.

Some flying experience desirable.

The Company has a wide range of designs in progress, including large civil aircraft, helicopters and advanced new military projects. Salaries, working conditions and prospects of promotion on merit are excellent. Facilities for subsidised private flying are provided at Filton.

Applications should be addressed to the Personnel Manager, Bristol Aeroplane Company Limited, Aircraft Division, Filton House, Bristol.

Jubilee

EITHER IT IS
— or it isn't!

JUBILEE has been our registered trade name for 30 years, and may not be used to describe any other clip.

THE FINEST CLIP in the world

L. ROBINSON & CO., (GILLINGHAM) LTD., *London Chambers GILLINGHAM, KENT. PHONE 5282*
L32625

accurate torque loading

The ACRATORK spanner is fully automatic. It can be used by unskilled labour with precision results. With ACRATORK it is impossible to exceed the pre-set torque load and its accuracy is unaffected by side loads. 8 standard models to suit a wide range of applications for loads up to 250 lbs./ft. Larger models supplied to special order.

ACRATORK

MARK VI PRECISION TORQUE SPANNER

WORLD PATENTS APPLIED FOR

WORLD DISTRIBUTORS

CORY BROTHERS & CO. LTD.

Corys' Buildings, Cardiff. Tel: Cardiff 31141

THE BRITISH AVIATION INSURANCE COMPANY LIMITED

UNDERWRITER & PRINCIPAL SURVEYOR

CAPT. A. G. LAMPLUGH

C.B.E., FRAeS., M.IAe.E.

HEAD OFFICE

3-4 LIME STREET, LONDON, E.C.3

Telephone: Mansion House 0444 (6 lines)

BRANCH OFFICES

MONTREAL	JOHANNESBURG	VANCOUVER
276 St. James Street West, Tel: Lancaster 6135	London House, Loveday Street, Tel: 33-3048	626 West Pender Street, Tel: Tatlow 2147
TORONTO	**CALCUTTA**	**BRUSSELS**
145 Yonge Street, Telephone: Adelaide 3221-2	2 Hare Street, Telephone: Bank 6237	99 rue de la Loi, Telephone: 123965

ESTD. 1887

Suppliers of machined and fabricated components in all Plastic and Allied materials to Britain's aircraft industry

Telephone: CLERKENWELL 2333/4 & 7247

UHLHORN BROS. LIMITED

We are proud to have the pleasure of supplying our precision products to many of the leading British aircraft constructors

Telegrams: UHLHORN, AVE, LONDON

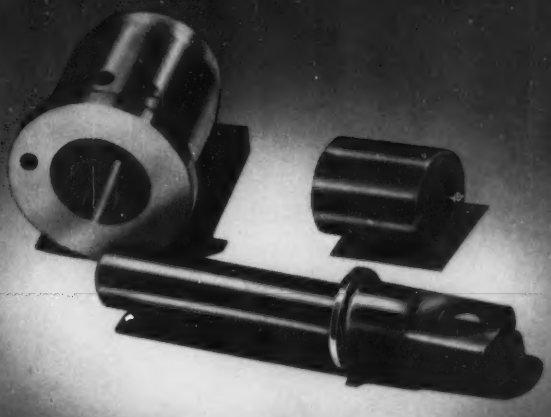
UHLHORN BROS. LTD., 53 CITY ROAD, LONDON E.C.1

INDEX TO ADVERTISERS

	Page
Acratork Engineering Co., Ltd.	36
Aerocontacts, Ltd.	32
Aircrew Co. and Jicwood, Ltd., The	25
Air Service Training, Ltd.	8
Alvis, Ltd.	19
Ashdowns, Ltd.	24
Aviation Developments, Ltd.	28
Aviation Traders, Ltd.	26
Blackburn and General Aircraft, Ltd.	5
Box No. 4140	35
Box No. 4169	34
Bristol Aeroplane Co., Ltd., The	25, 26, 28, 35, Cover iv
British Aviation Insurance Co., Ltd., The	36
British Messier, Ltd.	15
Burnley Aircraft Products, Ltd.	28
Central Office of Information (R.A.F.)	4
Chloride Batteries, Ltd.	2
Cross Manufacturing (1938), Ltd.	35
De Havilland Aircraft Co., Ltd.	18
De Havilland Propellers, Ltd.	30
Dowty Equipment, Ltd.	33
Dunlop Rubber Co., Ltd.	Cover i
E.M.I. Institutes	30
English Electric Co., Ltd.	Cover ii
Esso Petroleum Co., Ltd.	22, 23
Fairey Aviation Co., Ltd., The	12
Feltham and Son, Ltd., Walter H.	35
Hall and Sons (Bristol and London), Ltd., John	27
Heston Aircraft Co., Ltd., The	27
Hymatic Engineering Co., Ltd., The	34
Lewis, Ltd., D.	31
Leytonstone Jig and Tool Co., Ltd.	29
Lucas (Gas Turbine Equipment), Ltd., Joseph	Cover iii
Microcell, Ltd.	33
Ministry of Civil Aviation, The	33
M. L. Aviation Co., Ltd.	31
Muir and Adie, Ltd.	35
Newton Brothers (Derby), Ltd.	26
Normalair, Ltd.	3
Palmer Tyre, Ltd., The	31
Power Jacks, Ltd.	7
Powis and Sons, Ltd., David	8
Regent Oil Co., Ltd.	14
Robinson and Co. (Gillingham), Ltd., L.	35
Roe and Co., Ltd., A.V.	20, 31
Rolls-Royce, Ltd.	30
Salter and Co., Ltd., George	9
Sangamo Weston, Ltd.	24
Saunders-Roe, Ltd.	17
Shell-Mex and B.P., Ltd.	16
Short Aviation, R.A.	30
Short Bros. and Harland, Ltd.	1
Stream-Line Filters, Ltd.	30
Teddington Controls, Ltd.	6
Uhlhorn Brothers, Ltd.	36
United Aircraft Export Corporation	10, 11
Vandervell Products Ltd.	13
Vickers-Armstrongs, Ltd.	30
Vinten, Ltd., W.	6
Wiggin and Co., Ltd., Henry	21
Williamson Manufacturing Co., Ltd.	29
Wolverhampton Aviation, Ltd.	35

Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London and Watford, Herts. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office.

Super finish and accuracy



No. 4. These components, of extreme dimensional accuracy and super finish, ensure precise fuel distribution through the flow distributor to the atomisers or vaporisers.

FUEL AND COMBUSTION SYSTEMS FOR GAS TURBINE ENGINES

LUCAS

JOSEPH LUCAS (GAS TURBINE EQUIPMENT) LTD., BIRMINGHAM & BURNLEY

12 DECEMBER 1952

FLIGHT

THE Bristol AEROPLANE COMPANY LIMITED ENGLAND